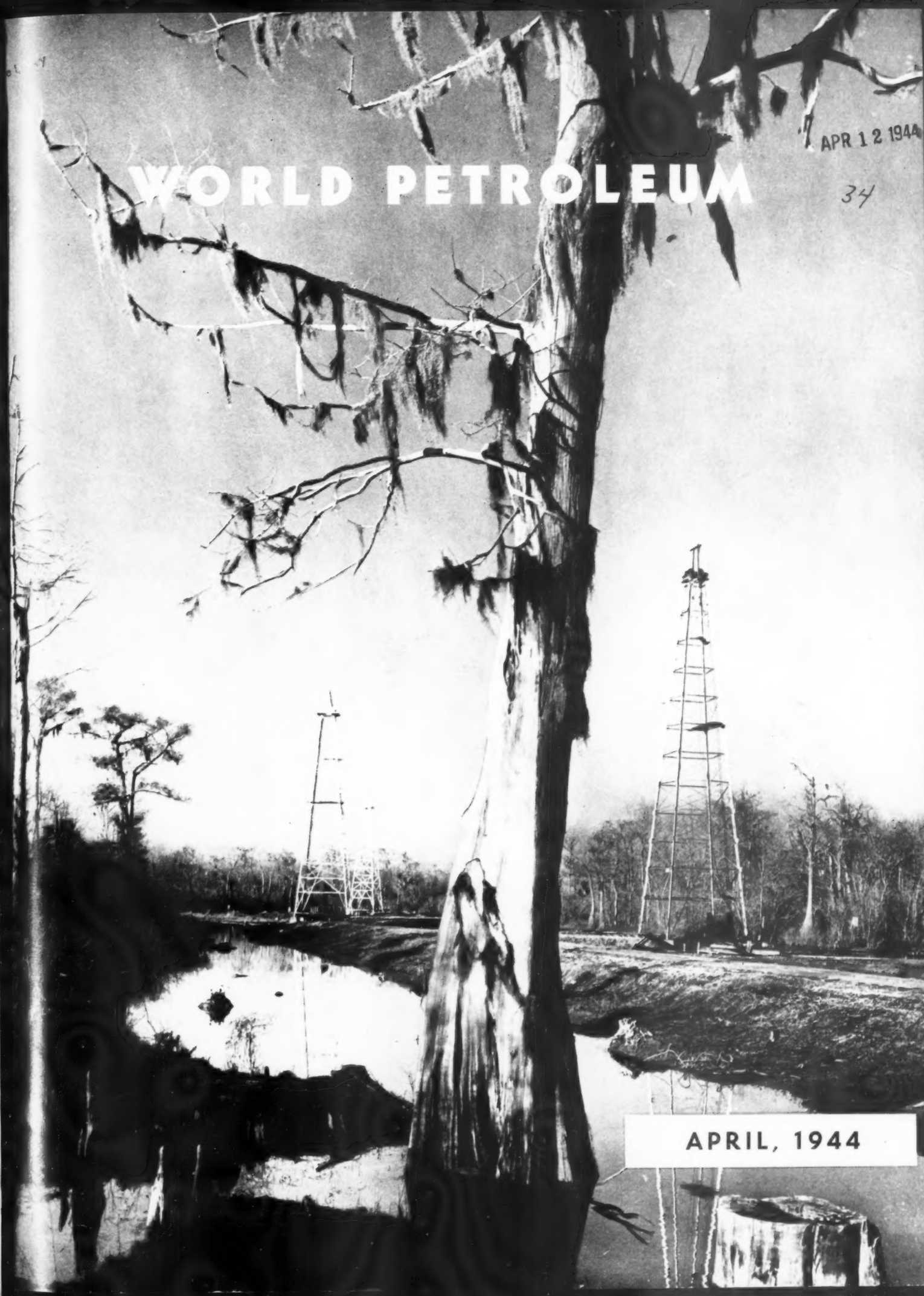

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# WORLD PETROLEUM

INCORPORATING PETROLEUM EQUIPMENT EXPORTER

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# EDITORIAL

## MID EAST PIPE LINE AND WORLD POLITICS

In the discussion that has gone on regarding the projected pipe line from the Persian Gulf to the Mediterranean, to be owned in perpetuity by the government of the United States, much confusion has been caused by the failure to state fully and clearly the objective of this unusual undertaking. Responsibility for this befuddlement rests primarily upon members of the federal administration who either do not themselves understand the full implications and possible consequences of the step—a reflection upon their intelligence that is hardly admissible—or who, for reasons which can only be surmised, do not care to present the whole picture before the public.

Secretary Ickes who made the first announcement of the decision to build the line, acting in his capacity as president of Petroleum Reserves Corporation, the company that is to build and own it, has taken on the task of publicly championing the project and defending it against criticism. Mr. Ickes has stated various reasons for this somewhat radical departure from past policy. One is to provide a reserve of a thousand million barrels of oil for use of the Army and Navy. Another is to offset the dwindling reserves of the United States. A third is to provide an outlet for oil produced by American companies to enable them to compete in world markets.

While insisting that the line is to be regarded as a part of the war effort and that this justifies rushing its construction with all possible speed Mr. Ickes does not claim that it can be completed before the end of the present conflict. He simply says that he does not know how long this struggle may last but that he is looking ahead and considers it important to be prepared for future wars. Since the military value of the undertaking has been particularly stressed this phase of the subject has attracted chief attention from the general public. As an argument for government ownership of the proposed pipe line however it has obvious weaknesses.

The billion barrel reserve which has figured so prominently in published statements regarding the pipe line is, as the designation implies, merely a reserve. It is not feasible to transport and store in the United States any such quantity of oil. In time of peace American ships can be fueled at any bunkering station in any part of the world and supplies for the Army can be had from whatever source is most convenient. In time of war ownership of oil is no guarantee of its availability for use. Oil will be held and used by the nation that has the armed power to control it. Oil concessions owned by British and American subjects in Rumania, the East Indies and Burmah have been of no use to the United Nations in the present war. They would have been equally useless had their ownership been vested in governments instead of individuals. If Hitler's attempted drive through Russia and Africa to the Middle East had been successful British ownership of a controlling interest in the Anglo-Iranian Oil Company or American ownership of a Trans-Arabian pipe line would have been no protection to either property but on the contrary would have supplied an added incentive for its confiscation or complete destruction. Since it is true that all petroleum products of all American companies are always at the service of the government whenever needed protection of these supplies and assurance of their accessibility rather than the question of title should be the important concern of government officials.

As to the assertion that the government must build the pipe line because the oil reserves of the United States will be exhausted within the next few years and a controlled source of supply is essential for the country's internal requirements the argument has even less basis than the claim of military need. Potential oil bearing areas of vast extent remain to be explored within the United States and few geologists entertain the belief that the country will be unable to provide oil for its normal demands for a long time to come. To the extent that imports are necessary the logical place to obtain them is from other countries of the Western Hemisphere where lines of communication are far less liable to interruption than are those extending across the Atlantic or Pacific.

Individual American enterprise and American private capital have developed by far the greater part of the world's oil production. These activities have embraced both Americas, Europe, the Middle East and the Far East. That the present federal administration, in contrast to its earlier course, should now recognize the national responsibility for upholding the rights and advancing the legitimate interests of its citizens engaged in such development is altogether commendable. Such procedure is certain to have solid public support. A firm policy such as that which brought about participation by American interests in the development of Mesopotamian oil in the early twenties will command respect without arousing political jealousies or creating such dangerous possibilities as are involved in the promise to protect the rights of the politically unstable governments of the countries affected by the pipe line agreement. Secretary

(*Continued on page 76*)

**The Odd Appearance of the Derrick at Left Will be Explained by Reversing the Page which Reveals that it is a Reflection in a Pool of Water.**

# PIPE LINE PROJECT ASSAILED BY INDUSTRY

WASHINGTON

INDUSTRY'S battle against the government's proposed entry, through Petroleum Reserves Corporation, into the foreign oil business promises to be long and bitter. Opposing sides are digging in, and every evidence points to a finish fight. Neither Secretary of Interior Ickes, who as Petroleum Reserves Corporation president is taking the brunt of the attack at the moment, nor industry leaders show any signs of lacking determination to slug it out.

So far as public discussion of the question is concerned, the main bout will come before the special 11-man oil policy committee of the Senate created especially for the purpose under the Brewster resolution, S. Res. 253. The group is made up of two members from each of four Senate standing committees, with three additional members chosen by Vice President Wallace, and comprises six Democrats, four Republicans and one Independent. They are: from Foreign Relations Committee—Chairman Connally, (D) Texas, and Vandenberg, (R) Michigan; Interstate Commerce Committee, Johnson, (D), Colorado, and Moore, (R) Oklahoma; Commerce Committee, Maloney (D), Connecticut, and Brewster, (R) Maine; Public Lands Committee, O'Mahoney, (D) Wyoming, and Gurney, (R) South Dakota. The three chosen by the Vice President are Lucas, (D) Illinois; Maybank, (D) South Carolina; and La Follette, (Ind.) Wisconsin. The group has $25,000 to defray expenses.

The committee has moved slowly toward getting organized, due to pressure of other matters on the floor of the Senate. At a meeting on March 23, Senator Francis Maloney of Connecticut, was elected chairman and a sub-committee was appointed to work out procedure and arrange hearings. The purpose of the committee, as provided in the Brewster resolution, is "to make a full and complete study and investigation with respect to petroleum resources, and the production and consumption of petroleum and pertoleum products, both within and outside the United States, in their relation to our national welfare and security" and "report to the Senate at the earliest practicable date the results of such study and investigation, together with its recommendations for the formulation of a national petroleum policy."

With as broad a field as this to cover, the committee may well take months to get around to the point where it is ready to draw up its final recommendations. No mention is made in the resolution of Petroleum Reserves Corporation or of the proposed Middle East pipe line, announcement of which brought to a head the controversy over foreign oil policy. However, there is a possibility that the pipe line deal may be placed well up on the committee's agenda and a preliminary report and recommendation concerning it may be made to the Senate.

The Brewster resolution, it will be recalled, came as a substitute for one previously offered by Moore of Oklahoma, S. J. Res. 110, specifically calling for the liquidation of Petroleum Reserves Corporation, and was intended to put the study on a broader basis. Senator Moore no doubt will seek to have the committee go directly into the pipeline deal, with the idea of stopping that before Secretary Ickes has time to "bull" it through. Administration pressure may be brought to bear to prevent this, and from the complexion of the committee it would seem that such an effort probably would be successful. However, a big point to keep in mind is the attitude of the members on the question of government versus private enterprise. Senator Connally, although from an oil state, may be willing to go down the road with the Administration on its oil policy. As a member of the Truman committee, he came to General Somervell's aid on the Canol project.

In the meantime Mr. Ickes is whipping the pipe line deal into shape. He has let it be known that he is going right ahead with it despite protests from the industry. The PRC president has said that he regards the project as both a war and post-war necessity and that he is "determined" to go ahead with its construction unless specifically called off by Congress.

At the March meeting of PIWC, fifty-five member companies voted for the resolution condemning the project as a post-war and not a war enterprise and likely to involve the United States in international complications. Four members voted "not voting". They were California Standard, Gulf, Texas Company, and Shell. The first three control the subsidiaries with which the agreement for the Middle East undertaking was made. Ickes' comment was: "The trouble is that I don't agree with the council. That's all. It is an honest difference of opinion."

In addition to the launching of the Senate committee inquiry, Washington interest is keyed up for the projected oil discussions to be held with the British, who have shown more than passing interest in the proposed entry of the United States into Saudi Arabia and Kuwait. The State Department has little to say concerning this matter, aside from a terse statement by Acting Secretary of State Stettinius issued as a simultaneous announcement in Washington and London:

"The governments of the United States and the United Kingdom are undertaking preliminary and exploratory discussions on petroleum questions. These discussions will be, in the first instance, on an expert technical level, and will take place in Washington."

These "informal conversations" with the British "on problems of mutual interest relating to oil", Mr. Stettinius explained, would lead at an early date to further conversations between the two governments "at a higher level". For conducting the "higher level" discussions, the President has appointed a group under the chairmanship of Secretary of State Hull, with Secretary Ickes as vice chairman, Under Secretary of War Patterson, Under Secretary of Navy Forrestal, Charles Rayner, petroleum advisor to the State Department, and Charles E. Wilson, vice chairman of the War Production Board.

Should these conversations lead to conclusions, Mr. Stettinius said, no decision affecting producing areas would be taken without consultation with the governments of the countries concerned. He also pointed out that this government is at all times ready to discuss economic problems with other governments and accordingly will welcome discussions with the government of any other friendly country concerning petroleum questions of mutual interest. This is taken as opening the door to conversations with Russia at some slightly later date and also possibly with the Netherlands.

In reiterating its opposition to the government's pipe line project and repeating its demand for dissolution of PRC, the Petroleum Industry War Council, at its March meeting, made the following statement of its objections:

(1) Although the Petroleum Reserves Corporation, which will construct and maintain the pipe line, was created under the war powers of the Reconstruction Finance Corporation, the project cannot be considered a war measure because it is unlikely that the pipe line can be completed and in operation before the termination of the present European war.

(2) The agreement will put the United States government directly into an international transportation business in the Middle East, as owner and maintainer of the pipeline, and the United States government will declare in the contract that it will promote and protect the interests of the governments of the territory traversed, entirely without reference to the future nature or jurisdiction or policies of such governments and without reference to existing spheres of influence which may be claimed by other countries.

(3) The optioned reserve of one billion barrels of oil in the Persian Gulf fields controlled by American nationals is meaningless, because in times of war or other emergencies all the oil produced by American companies or citizens anywhere in the world is available to the American government if it can control the necessary transportation routes to the desired destinations.

(4) Adjoining nations may well consider that the United States government has taken direct

*(Continued on page 53)*

IMMEDIATE construction of a pipe line from the Persian Gulf to the eastern shore of the Mediterranean remains the fixed determination of the federal administration of the United States. That in substance was the message delivered to the Petroleum Industry War Council at its meeting last month by Secretary Ickes, speaking in his capacity as president of Petroleum Reserves Corporation. Opposition on the part of the industry will have no effect, he informed them, because the decision already has been made. For the same reason apparently any action by Congress to investigate or to pass judgment upon this expression of oil policy as determined by the executive branch of the government will have no practical importance. The project is being treated as a matter of military necessity on which public sentiment is not taken into account.

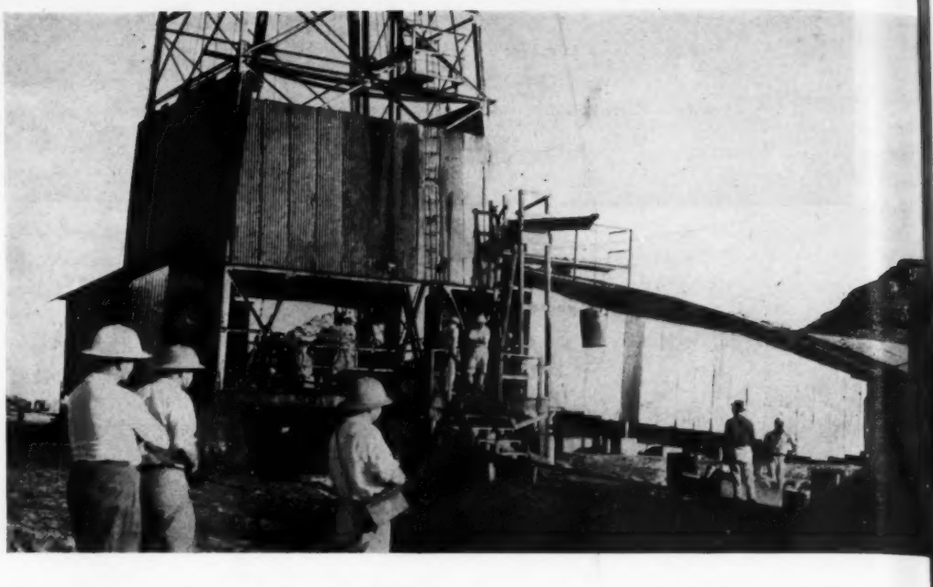
While the contract committing the government to the construction and ownership of the pipeline was drawn in the name of Petroleum Reserves Corporation it obviously would not have been made without the specific authorization of the President himself. Secretary Ickes has publicly stated in fact that "every act proposed or undertaken on the part of this [Petroleum Reserves] corporation has been discussed freely with the President and has had his consent". In addition it is said to have received the approval of the chiefs of staff of the Army and Navy. The position taken by those within the Administration is that the President has the authority to engage in such an undertaking under the war powers voted to him by Congress and that he can direct the expenditure necessary for it through the

Reconstruction Finance Corporation. One point made clear by Mr. Ickes was that the proposal originated with the representatives of the government and not with the oil companies who are parties to the contract. This was regarded as an indirect reply to the charge that representatives of the oil companies had influenced the government's decision.

During the past few weeks special efforts have been made to speed up completion of the pipe line contract. Meeting in almost continuous session the parties to the contract worked for days to finish up the many details not covered by the "agreement in principle" made public by Secretary Ickes in February. Pressure has been applied all along the line to obtain final acceptance of the agreement before mounting opposition can make itself felt. Equipment manufacturers are reported to have been told to hold themselves in readiness to start production of supplies as soon as the final contracts have been signed and detailed plans for the shipment of materials are said to have been prepared. Unofficial statements were made that within sixty days after signing of the contracts materials for the pipe line would be on their way to the Middle East.

Preliminary plans of PRC contemplate the movement of machinery and equipment in shipload lots and arrangements are reported to have been concluded for the rapid assemblage and delivery of the materials required and for completion of the survey of the route by the time the first shipments arrive at the terminal points so that actual construction can begin immediately. As a factor in time saving it is reported that the government itself through PRC will build the line, placing contracts for the various sections with leading pipe line constructors including some of those who built the Big Inch line from Texas to the Atlantic Coast.

While the statement accompanying the announcement of the preliminary agreement left the location of the western terminus of the line in doubt as between Haifa in Palestine where one leg of the Iraq pipe line ends and Alexandria in Egypt, the consensus among international oil men is that the former site is the more probable. It is estimated that this may cut as much as $25,000,000 from the total cost of construction in addition to saving time in completing the work and avoiding the payment of taxes that might be imposed by the Egyptian government. Many details in regard to the line which were not covered by the preliminary agreement are expected to be made public when the definitive contract is concluded.



*Dammam No. 1—Discovery Well.*

While the preliminary agreement between Petroleum Reserves Corporation and the oil companies related only to the projected pipe line the companies have undertaken a vast development program for the expansion of production and the provision of refining facilities which will require the ultimate expenditure on their part of probably a dollar and a half or more for every dollar spent by the government on the main transportation system.

To fulfill their obligation in respect to the billion barrel supply pledged for government use the companies propose to develop as quickly as possible a known reserve of that extent. It is practically certain that the fields already discovered in Saudi Arabia contain many times that amount but to bring the requirement well within the realm of certainty, Arabian American already has embarked upon a program for largely expanding its survey and drilling activities and is recruiting technical oilfield and refinery personnel for this service. It will put into operation from twelve to eighteen heavy rotary rigs for deep drilling in addition to a number of portable outfits for survey work. The campaign of exploration and drilling as laid out, together with the building of gathering lines to connect producing fields with the main pipe lines is estimated to call for the expenditure of $50,000,000.

At the present time Arabian American operates at Ras Tanura on the Persian Gulf a topping plant of 3,000 bbl. daily capacity which is fed by a pipe line from the Dammam field about 40 miles distant. This plant was built in accordance with the company's contract with King Ibn Saud to supply products for use within the kingdom. These requirements amount to about 3,000,000 gallons yearly, including gasoline, kerosene and lubricants. Under the program now adopted this installation will be replaced by a complete modern refinery of 50,000 bbl. daily capacity at a cost of some $40,000,000 to $50,000,000. This refinery presumably will turn out products for distribution east of Suez.

kas Tanura will be the operating headquarters of the company in Saudi Arabia and to provide for its greatly enlarged personnel the company will construct a complete camp with up-to-date housing, recreational and sanitary facilities on which $8,000,000 will be expended.

At the Mediterranean terminal of the pipe line Arabian American will eventually erect a second large refinery of 50,000 bbl. daily capacity, the cost of which is projected as $48,000,000, to be increased later to $62,000,000 by the installation of additional units. This part of the project is still well in the future and has not yet entered the blue print stage, but when built this refinery will handle the company's share of the crude transported by the government owned pipe line or such part of this share as it is capable of processing.

On Bahrein Island in the Persian Gulf the Bahrein Petroleum Company, controlled by the same interests that own Arabian American, is now engaged in enlarging its refinery from its present throughput of 30,000 bbl. to 58,000 bbl. at full capacity, including a unit for the production of 100 octane gasoline. Present output of Brahein wells is about 20,000 bbl. daily and the refinery has been using some Arabian crude. The added capacity will be met either by increasing this supply or by further drilling on Bahrein.

An additional feature of Arabian American's program is the erection of a large stabilization plant to treat the crude destined for shipment through the pipe lines.

American entry into the search for petroleum in Saudi Arabia dates back to 1933. In that year a contract signed by King Abdul Azziz ibn Abdul Rahman al Faisal Saud, to give that potentate his full and resounding title, and by Lloyd Nelson Hamilton, representing the Standard Oil Company of California, conferred upon that company for a period of sixty years the exclusive right "to explore and search for and drill and extract and treat and manufacture and transport and export" all manner of petroleum, asphalt, oil, natural fats and other carbonaceous matter within an area not closely defined but extending approximately two hundred miles inland from the eastern coast of the country. The contract provided for a series of loans to the King and for the payment of an annual rental during the period of preliminary exploration. Following the discovery of oil in commercial quantities a royalty of four shillings gold per ton or its U. S. equivalent was to be paid by the company which undertook also to supply various petroleum products for use within the Kingdom. The company was at liberty to withdraw at any time on thirty days notice but could be dispossessed only in case of a definite breach of contract through failure to make stipulated payments.

While the existence of oil beneath the Arabian sands had not been definitely proved at that time the opinion of many geologists was that important deposits would be found. In an article relating to the concession and to other Near Eastern developments published by World Petroleum at the time* it was stated that "since local consumption in these countries is a negligible quantity it follows that the oil originating in the area between the Mediterranean and the Indian Ocean must displace supplies from other less economical or less favorably situated areas. . . . Within five or six years the world's markets may be called upon to absorb some 7,000,000 to 8,000,000 tons of added production from Near Eastern territory". Extension of Standard of California's operations to Saudi Arabia was a logical step from the company's viewpoint since it was actively developing production in the Bahrein Islands, just offshore in the Persian Gulf. The concession was not won without stiff competition, however, and it was reported at the time that one factor influencing King Ibn Saud's decision in favor of the American company was his conviction that its interest would be confined to commercial exploitation and that he need have no fear of political infiltration such as might be attempted if the agreement were to be made with representatives of a European nation.

Actual development in Saudi Arabia began in 1936 when the first producing well was completed in the Dammam area. The first wells, drilled with cable tools, found oil at a depth of around 2,000 feet. After the introduction of a rotary rig, a deeper horizon was tapped below 4,000 ft. Wells subsequently drilled found production at still greater depths.

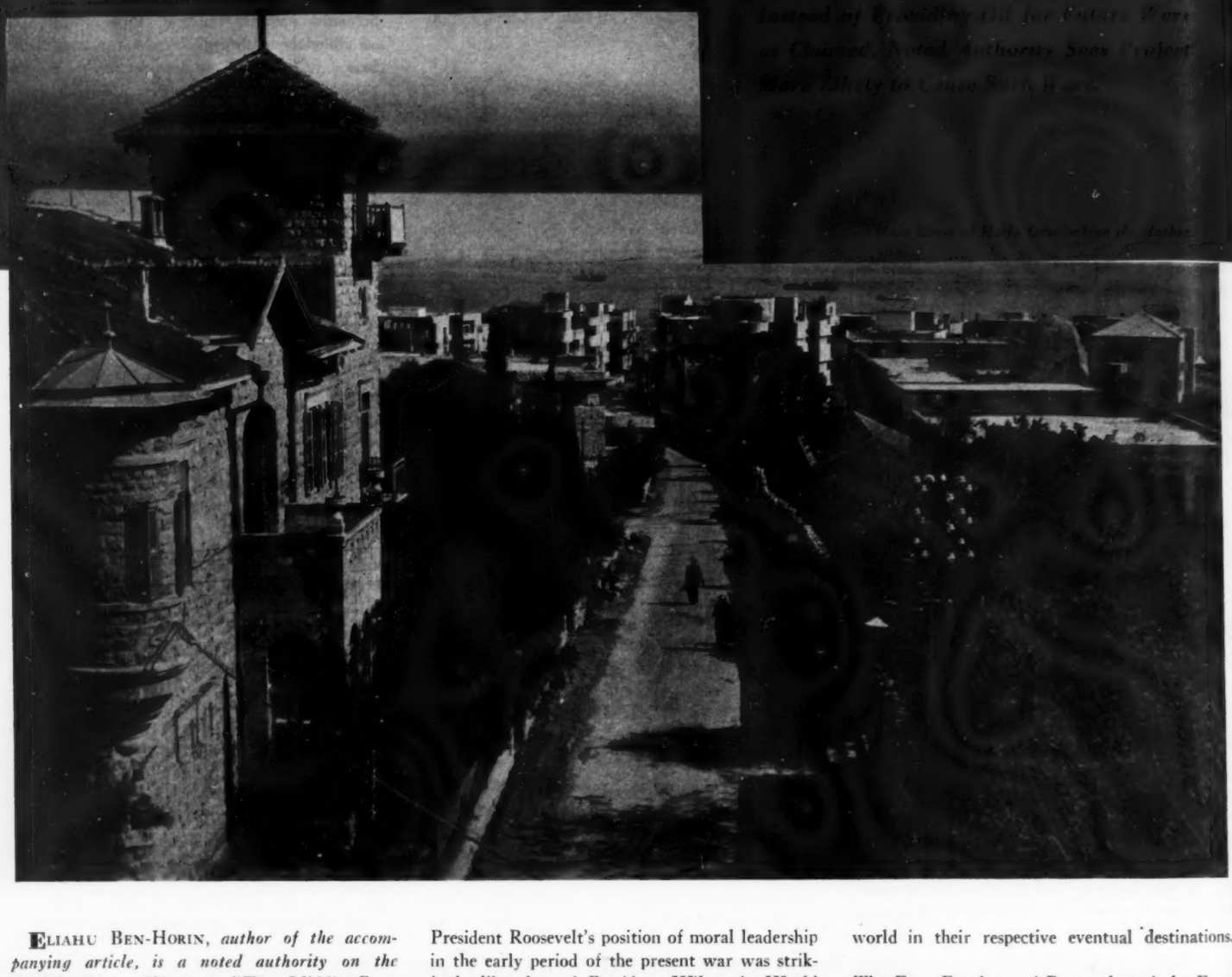
After the presence of oil in subtsantial quantities had been proved, the concession was expanded to include virtually all the territory under Ibn Saud's authority. An arrangement was made with The Texas Company by which the latter became a joint owner with Standard of California of the companies operating in the Persian Gulf area, including the California Arabian Standard Oil Company, the title of which has now been changed to Arabian American Oil Company, Bahrein Petroleum Co., Ltd., and the California Texas Company which is the marketing organization.

Practically all the Arabian American's production to date has come from the Dammam field where twenty-five wells have been completed. Daily production is now 15,000 bbl. although the wells are capable of a very much larger output. Other fields where production has been found are Abu Hadriya, about 100 miles northwest of Dammam, where one well has been drilled to a depth of 10,000 ft., and Abqaiq which is regarded as the most promising field yet located. Many other favorable structures have been located and await exploration by the drill. Thus far no structure explored has been found to be without oil.

So small a part of Saudi Arabia has been tested by exploratory drilling that no reliable calculation of its probable reserves can be made but geologists who have visited the area believe that the area immediately around the Persian Gulf will prove to be one of the world's greatest repositories of oil. Known reserves of Saudi Arabia are roughly estimated at 4,000,000,000 to 5,000,000,000 bbl. but this figure, it is admitted, is no criterion of the amount of oil that will be discovered by further exploration. The prediction made ten years ago in World Petroleum's pages that production from this territory would reach 50,000,000 to 60,000,000 bbl. yearly seems to have been far on the conservative side.

* World Petroleum—October 1933. "Saudi Arabia Looms as Potential Oil Power".

*Dammam Camp of Arabian American Oil Co.*



ELIAHU BEN-HORIN, *author of the accompanying article, is a noted authority on the Middle East. His book "The Middle East: Crossroads of History", recently published, has attracted widespread attention, as it represents a thorough study of the Middle Eastern political pattern in war and peace. Since then, Mr. Ben-Horin's articles dealing with various political problems of the Middle East, have appeared in leading American magazines.*

*To his analysis of Middle Eastern problems, Mr. Ben-Horin brings first-hand knowledge of the area, its conditions and peoples. He lived there for many years, editing magazines and newspapers, travelling extensively in Arab lands as well as in the Balkans, Europe and Africa.*

President Roosevelt's position of moral leadership in the early period of the present war was strikingly like that of President Wilson in World War I. Europe applauded the principles enunciated by Wilson but the political leaders of the Allied powers disregarded them in framing the peace and sent the apostle of liberalism home a disillusioned man. America turned to isolationism which was above all a reaction against European imperialism and an expression of the desire to avoid involvement in imperialistic policies.

While there was a close similarity between President Roosevelt's point of departure in this war and that of President Wilson twenty-five years earlier, there seems to be all the difference in the world in their respective eventual destinations.

The Four Freedoms of Roosevelt and the Fourteen Points of Wilson were both inspired by the same spirit of Americanism, democracy and freedom. The messages of the two Presidents to a world at war were essentially alike. In different words and style, they both justified America's going to war and their call to America's youth to the supreme sacrifice by promising that these would be the wars to make the world safe for democracy, wars to defend our way of life, "wars to end war." Furthermore, the reaction of America's allies in this war to Roosevelt's expressions of idealism was exactly the same as the reaction to Wilson's program. In both cases, lip-service has been paid to America's declaration of

WORLD PETROLEUM MAP

*Map of Middle East Showing Probable Route of Pipe Line.*

war and peace aims, and official agreement to it has been recorded. In both cases, this apparent endorsement of the American program for a better world lasted as long as the Allies were on the defensive and America's help was of paramount importance for the ultimate outcome. Now as before, after the first favorable turn in the fortunes of war, there appears a disposition to forget earlier pledges and to reestablish the old routine of power politics.

Here, however, the parallel comes to an abrupt end. In the last war, the European members of the Allied group had to maneuver their imperialistic plans in a clandestine manner, and to give at least an appearance of regard to the "self-determination of nations" and like principles. Now, the European leaders embark openly on plans for the extension and consolidation of their power, for America's President seems to have decided to take an active hand in the imperialistic game. To the student of international affairs this is the real significance of the Arabian pipe line project, initiated and actively sponsored by the Administration.

I listened very attentively to the recent debate at "America's Town Meeting of the Air" between Harold L. Ickes, Secretary of the Interior and Petroleum Administrator for War, and Senator E. H. Moore of Oklahoma. When the moderator, Mr. Denny, in reply to a question, stated that the Arabian pipeline project was not meant to satisfy oil requirements of the present war, Mr. Ickes rebuked Mr. Denny, emphasizing that in planning the pipeline the government had in mind both the requirements of this and future wars. We shall later deal with the effect that the pipeline may have, if at all, on oil supplies in the present war, but it is instructive to notice how smoothly a representative of the government speaks of future wars.

The "Four Freedoms", which sounded so vigorously refreshing when promulgated, seem to have receded into the background; the "Atlantic Charter", seldom mentioned now, is covered with rust; but future wars are accepted as a certainty. We are told that our oil policy is being dictated by the requirements of those future wars; in reality our oil policy, as expressed in the Arabian pipeline project, will be more than likely to cause future wars, if nothing else will. For we must remember that this planned pipeline will be located in an area which no conqueror could ever by-pass. The Middle East has figured prominently in almost every great conflict in history, from the days of Alexander the Great, Genghis Kahn and the Arab Kaliphs to Napoleon and the two world wars. There is little doubt, moreover, that after this war the Middle East is likely to be a main object of international rivalry. Not only oil in vast quantities is treasured there but the Middle East itself is a strategic key position to the trade and communications of the world. It is here, at the crossroads of all wars, that Mr. Ickes plans a government-owned pipeline.

Let us look at the geography of the situation. To the north, Soviet Russia borders on the Middle East and is the only great power that is directly adjacent. Great Britain, on the other hand, is thus far in control of the Arab lands in this area, of the African shore of the Mediterranean and the Red Sea, as well as of all the sea lanes and naval outposts. Where does America appear in this picture? What real positions of power, political, strategical, military or otherwise, can America claim in the Middle East? To have a pipeline implies the ability to protect it. How will that be done, at a distance of half way around the globe, in an area which the United States neither rules *de jure* nor holds *de facto?*

Above all, by what deviation from both logic and fundamental laws of historic developments have the promoters of the pipeline scheme decided that the oil stored in the Middle East will serve America in case of future wars? Let us suppose that the pipeline has been constructed, and that the billion barrels of oil which the government wants have reached through the pipeline the Eastern Mediterranean and have been stored there for the government, assuming for the moment that such a thing is possible. We are being told that this billion barrels of oil is the main object of the contract, and that it is a reserve for "future wars".

I am sorry to say that this line of argumentation by the authors of the pipeline project represents the most serious flaw in their plans, because the United States government may possibly use the Middle Eastern oil in peacetime, but certainly not in wartime. In peacetime, the United States can dispose of American-owned oil anywhere in the world, including the products of the oilfields in Rumania, Italy and Poland, but now it is Hitler who enjoys all the oil of continental Europe outside of Russia. When American fliers bombed the Ploesti oilfields, they bombed American-British property; and when the Luftwaffe blitzed London and Coventry, their planes may have been fueled in part with American-British owned oil.

This happens inevitably in every war. International law, the rules of property and ownership, function only in a world at peace. The moment a war occurs—one of those "future wars" of

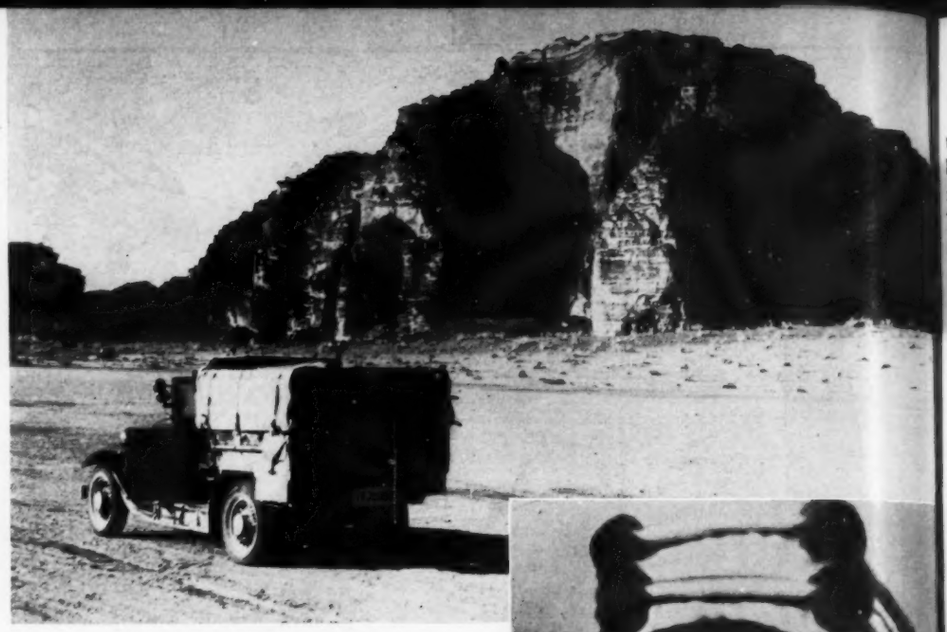
which Mr. Ickes is talking—it is only the law of might and of actual immediate possession that governs affairs. The Suez Canal Company is controlled by British-French shareholders, but this is true in peacetime only. If Graziani, in his first push across Lybia, or Rommel, in his later advance, had succeeded in reaching the Canal, the Axis obviously would have controlled it, not Britain or France.

All this is elementary, but nevertheless it seems to have escaped notice by the government of the United States. Having behind them the experience of two world wars, in both of which the Allied war effort had to be oiled mainly by American and South American oil, because only this oil has been accessible in time of war, they now embark on an adventure in Arabia, arguing that it is dictated by military requirements. Nothing could be less sound and less practical. When I say "nothing", I should in all fairness make one exception: Mr. Ickes' claim that the Arabian pipeline may render service in the present war is even less sound and less practical.

The urgency of the pipeline project, involving allotment of huge quantities of steel, other materials and shipping space, besides labor and capital, is being officially advocated in the name of the war effort. However, whether the invasion of the European continent will take place in 1944, as repeatedly announced, or next year, it is accepted by all that the European war cannot last much longer than the year 1945. On the other hand, any expert in pipelines with minimum knowledge of the local desert terrain and of all the problems involved in the construction of a pipeline a thousand miles long at such a far distance from the home base, would say without the slightest hesitation that the Arabian pipeline could not possibly be built before the end of this war, even if one takes the most pessimistic view as to its duration.

It seems that the Secretary of the Interior himself feels how thin is his argumentation on this point, and that is why, in an answer to a question at the above debate, he stated that after the end of the European war, we shall have still on our hands the Japanese war and the pipeline may serve there. Mr. Ickes should refer to a map of the world. He would then notice that the oilfields of Arabia lie much nearer to the Pacific war theater than the Mediterranean outlet of the proposed pipeline. If the government is so set on pipelines, the war against Japan would require a pipeline laid from the Persian Gulf eastwards, not westwards. The argument of the Japanese war might be in place, if a pipeline across India to Madras on the Indian Ocean were contemplated, but it is clearly out of place in dealing with a pipeline ending in Jaffa, Palestine, or elsewhere in the Eastern Mediterranean.

There remains one more argument of the government, which, if sound, would be of great appeal to Americans, and this is the value of the line in offsetting "our dwindling oil reserves".



*View in Transjordania Which Pipe Line is Expected to Cross.*

Everyone knows of course that oil is of paramount importance in peace and war alike. Transportation, industry, all technical progress depends on oil, probably more than on any other natural resource. We also know that America, technically the most advanced country in the world, needs more oil than any other nation. It consumed a large percentage of the world's oil in the past, and will continue to do so. Now, this official statement sounds alarming, and every American naturally feels that something has to be done to prevent an oil shortage.

Indeed it would be alarming if it were true. But it is not. Hard figures—official figures of the government—bear witness to the fact that America has *now* within its continental borders 40 percent of the world's known oil reserves. In addition, American oil interests control or share in the control of South American, Middle Eastern and almost all the European oilfields (except Soviet Russia's). Altogether, American companies and nationals now own about sixty percent of the world's total known reserves. The American oil industry itself is satisfied that no shortage of oil is indicated. J. Edgar Pew, chairman of the Committee on Petroleum Reserves of the American Petroleum Institute (which unites in its program of activities all the oil producers of the United States), stated only a few weeks ago that American oil resources "will be able to meet this nation's requirements for oil products for many generations to come", but he added also the demand of the industry for "an adequate and fair price for its products". And this is another feature of the oil situation worth discussing.

Thus, both the general figures of the world's and America's oil reserves and the authoritative opinion of those who know most about the subject do not warrant alarm over the prospective exhaustion of our oil reserves. There have been similar attempts to alarm the public, none of which were ever warranted. But even if there were a true alarm, the Arabian pipeline would offer no remedy to our oil shortage. If our reserves diminish, the effective thing to do obviously would be to discover new reserves. The Arabian pipeline represents nothing of the kind. The oil of Saudi Arabia, Bahrein and Kuwait has been discovered. The pipeline is only a vehicle for the transportation of the oil over a certain distance. It in no way increases the reserves.

*King Ibn Saud.*

American oil companies, with the active diplomatic help of the government, obtained the concessions in Arabia and did the prospecting there, as they did elsewhere throughout the globe. It is stating a simple fact that America leads the world oil industry; it is the richest oil country in the world, and is the main supplier in a war of humanity versus barbarism. This American oil industry, as mentioned already, remains optimis-

tic with regard to our oil reserves and claims to be perfectly capable of taking care of America's requirements "for many generations to come". There is, however, a controversy between government and industry with regard to the prices of the oil products. The industry complains that the present prices provide no adequate incentive to prospecting for new oil or to deeper drilling into America's earth. The government seems to have decided to counter this demand by buying a billion barrels of Arabian oil at a lower price. On the face of it, this may impress some Americans as a highly beneficial act on behalf of the oil consumer. However, I am afraid that even this much credit is not due to the Arabian pipeline project.

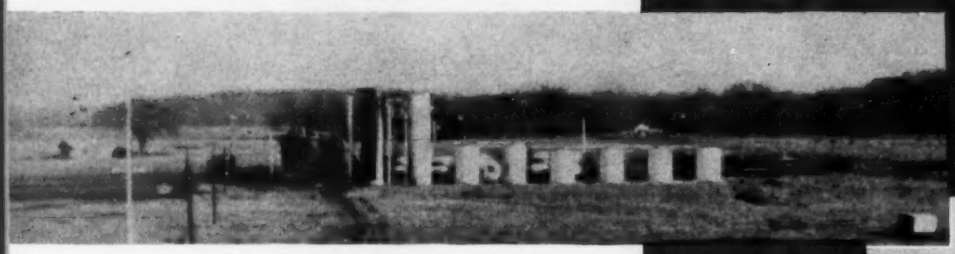
In the evaluation of this controversy it may be useful to refer to the one experience which American oil interests, together with the British, French and Dutch, have had thus far in the Middle East. I mean the Iraq Petroleum Company, which exploits one of the richest oil areas in that region. The Iraq concession is now seventeen years old. It is eight years since Iraq oil started to flow through the pipeline to the Mediterranean. Was it cheap oil that Iraq Petroleum Company has obtained, or was it a costly product? When one adds royalty at the rate of four shillings gold per ton (which is equivalent to a little over eight shillings sterling) to the local taxes and to the rentals which the oil companies pay to the Iraq government for the provinces of Basra and Western Tigris, and a non-interest bearing loan of three million pounds (plus a new recent loan of one and one half million pounds) and all fees and educational grants—one arrives at a payment amounting to somewhere in the vicinity of 40 percent of the value of the crude at the Mediterranean. From 1925, when the concession was obtained, up to the end of 1941, the payments of the Iraq Petroleum Company to the Iraq government totaled more than $80,000,000, as against a total production of over 180,000,000 barrels.

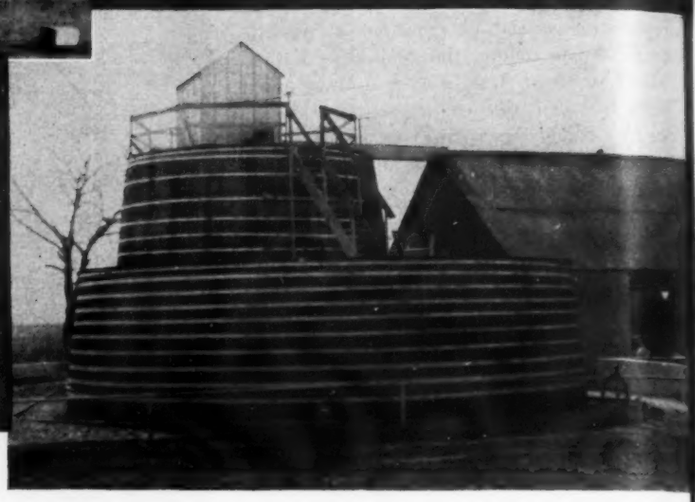
That the Iraqi is not a poor trader seems to be demonstrated by the foregoing. The royalties paid to Iraq are probably higher, over a period, than the oil companies pay in any other part of the world. In the United States the royalties amount to 13.2 percent of the crude value at the seaboard; in the Dutch West Indies 12 percent; in Mexico, before the government took over the oilfields, from 14 to 33 percent; in South America from 7.15 to 16 percent. The Iraq government, however, managed to get approximately 40 percent. This experience in the Arab Middle East would hardly warrant expectations of getting cheaper oil from Arabia. The terms of the Saudi Arabian and Bahrein concessions may be more favorable than those of the Iraq concession, but the people, the conditions, the "trade climate" are about the same. And so is the paramount law of Baksheesh. Baksheesh is not included in concession contracts, but it has to be paid in Arabian countries, starting with kings and sheiks and ending with the local foreman. It may amount to many millions of dollars. Indeed, according to reports in the press, the first thing the American government did on behalf of the planned pipeline was to pay $25,000,000 dollars to King Ibn Saud, and this is only a beginning.

*Street Scene in Jidda, Port on the Red Sea.*

Money and lend-lease arms for Ibn Saud, even before the pipeline project gets underway, mark the entry of the government upon its new Middle Eastern policy. A complete change of heart in the Palestinian-Jewish-Arab problem is a second feature. Because of the pipeline and the commitments it involves, the present administration must turn a deaf ear to the cries of tortured Jewry in Europe and to the expressions of hope for Jewish national renaissance in Palestine. The traditional pro-Zionist policy of America, which found innumerable expressions over the past quarter of a century, appears now to have been discarded, notwithstanding the fact that the United States was officially committed to the Balfour Declaration and the Palestine Mandate. A resolution favoring free Jewish immigration into Palestine and the establishment of a Jewish Commonwealth there, recently introduced in Congress, was tabled under the pressure of the administration in general and the War Department in particular. All this is natural, because the moment power politics and imperialistic aspirations become the guiding spirit of a government, idealistic and humanitarian considerations do not count.

Stripped of all its borrowed trappings—of war urgency, future military requirements, replenishment of dwindling oil reserves and the provision of a source of cheap oil—the Arabian pipeline project stands as a doubtful venture in imperialism. If it offers neither new oil reserves nor additional security, it certainly presents a serious and dangerous politico-military involvement of the United States. Not oil for "future wars" but future wars for oil would be the more likely consequence of the project.





IN THESE times of impending oil shortage there is a great demand for new oil, more wildcats and increased production to meet the requirements of the military forces and to care for essential civilian traffic at home. Everywhere the cry is for more oil and new reserves. Recently Paul D. Torrey, Consulting Engineer and Geologist, and one of the early technical exponents of secondary recovery by water flooding gave a very apt illustration of the significance of secondary recovery with the use of an old story.

"During the time of exploration of the Western Hemisphere a ship, having suffered from violent storms in the South Atlantic, was driven far from its course. The crew found itself in dire straits on account of lack of fresh water. They had practically given up hope of survival when to their joy they observed a vessel approaching from the western horizon. Signals were immediately run up on the masts 'Give us water or we perish.' The reply came back 'Let down your buckets where you are, you are at the mouth of the Amazon.' There was fresh water in abundance coming from the mightiest of rivers but because of the size of the current it had not been recognized. Correlatively speaking secondary oil reserves constitute oil in quantity comparable in magnitude to the flow of a great river combining itself with the primary source of water in the sea, reserves which scarcely have been recognized in the past even though they are just as proven as a large percentage of primary reserves of the nation."

Estimated secondary reserves of the United States approximate four billion barrels including only those states in which this method of operation has been tried and found to be workable. California with its great potential of secondary oil is not included because of the absence of such operations up to this time and the resulting lack of data and experience. There is great probability that a very substantial addition will be made to the above reserves after pioneering work has been carried on in that state. In the meantime the present secondary reserves are impressive when compared with the accepted primary reserve figure of approximately twenty billion barrels. In other words, when secondary oil is taken into account the nation's potential supply of crude petroleum is increased twenty percent to give a total of twenty-four billion barrels.

With these estimates of reserves at hand the question that naturally follows is: "Are the reserves available and if not what is the reason?" The answer is, they are not economically available even though they are physically available. Under the present economic condition which has been imposed upon the oil industry by the federal government the largest share of secondary oil may be likened to a frozen asset. It is in the ground; ways and means are known so that it could be obtained, but one vital factor is missing and that is a sufficient price per barrel of oil produced. Operators cannot and should not be expected to deliver oil at a price less than, or even equal to, the cost required to investigate, develop and operate a property. However, this is what a producer has to do at the present time with all but his highest quality acreage if he proceeds with secondary recovery.

During the past ten years in the Mid-Continent there has been a considerable amount of secondary development by water flooding in the old shallow stripper areas. Experience acquired in this period amply illustrates the absolute necessity for a higher price. The method of production has been proven so far as physical aspects are concerned but the economics is a different story. Last fall the Bureau of Mines released an excellent publication[1] giving the case history of each water flooding project in Oklahoma. Since then H. M. Ryder, engineer of Bradford, Pennsylvania, has made an analysis[2] of this report. Ryder points out that the average net loss to the producers has been approximately twenty-three cents per barrel with a total loss of $3,500,000. Part of this rightfully should be charged to education in the art of choosing the right properties to develop together with best operating methods. At the same time a large percentage of it would not have occurred had the selling price of oil been reasonably higher. Ryder concludes that only 22 percent of the total 7,985 acres developed has proven economically successful. This is not a happy condition for an operator to face when contemplating future secondary developments. At this rate dollar oil certainly offers no incentive for the investment necessary to promote such operations.

Another example of the importance of price is the difference in estimation of available reserves at the present level and at higher levels. The estimated total of secondary reserves for Oklahoma has been reported as approximately 900 million barrels; however, under present conditions it is doubtful that, at the most, more than 275 million barrels are available. An increase of about one dollar per barrel probably would be required before the total would be available. Approximately the same ratio holds for other areas. Even though these amounts are estimated to be obtainable under existing conditions it is problematical as to whether or not there is sufficient incentive to cause the operator to make the necessary investment.

Of course these secondary reserves are not immediately available because of time required to get a project underway, together with time required for depletion. Still the oil is underground, waiting to be extracted and one to two years intensive development should supply a very substantial addition to the nation's daily average production. Had positive action been taken to increase the price eighteen months ago there very probably would have been a very substantial increase in daily production of secondary oil by now. Its contribution to the war effort would have been increasing at a time when rates from so many primary fields are decreasing.

[1] Taliaferro, D. B. & Logan, D. M., History of Water Flooding of Oil Sands in Oklahoma, Bureau of Mines, R.I. 3728, November 1943.

[2] Ryder, H. M., Secondary Recovery in Oklahoma, Independent Monthly December, 1943, pp. 15-16.

Secondary recoveries by water flooding vary greatly depending upon sand conditions existent in the different areas. Past experience has shown recoveries ranging from less than one thousand barrels per acre on sub-marginal properties to over fifteen thousand barrels per acre for those most favorable. Highest recoveries to date have been obtained in the Eastern fields where this method has been in use extensively for the past twenty years.

Many factors make up the over-all cost of a secondary program. First of all is the preliminary investigation and study to determine whether or not a lease or pool is adaptable to development and if so the type operation to be used. This in itself is a task of large magnitude whether the property is one already owned by the operating company or whether it is one to be purchased. Drilling of test wells and the coring and analyzing of the productive sand or sands is usually necessary before a final decision can be reached as to the probability of success of the venture. When entering into a new field or area it often is considered advisable to commence operations with a pilot flood so as to obtain direct field evidence concerning the workability of the process. If the pilot floods are used to full advantage, they are in themselves expensive. If the success or failure of the method involved is to be determined by the pilot very complete and minute details should be kept. Also enough acreage should be included in the experiment so that results may be considered representative of the general area. Depending on depth of sand together with information available, the cost of such investigations may vary between two to three thousand dollars and several hundred thousand dollars. If the operations prove a success then this investment will be repaid; however, if they are not successful it will be almost a total loss and the operator will have drilled another "dry hole."

Development costs vary greatly, again depending upon local conditions such as drilling costs, depth of sand, well spacing, condition of present equipment and other factors. Development on flooding projects in existence has varied from as low as three to four hundred dollars per acre in the shallow sands of North Central Texas to as high as three thousand dollars per acre in Pennsylvania.

One important item in development of old stripper properties is the presence of old wells and abandoned wells. In the shallow areas it has been found necessary to go into all of the old holes and plug the oil sand off with cement. This in itself is expensive considering the number of holes that have been drilled in the past. One Mid-Continent operator reports that plugging costs on one group of old leases of approximately 300 acres amounted to nearly twenty-five thousand dollars.

It is essential to install good equipment in new development if the property in question is worth re-drilling. If maximum recoveries of oil and a profit are to be obtained an operating life of ten to fifteen years should be assumed when choosing materials for installation. Many attempts have been made to flood a sand in a hurry so as to get in and right out again with quick profit; however, it seems probable that large oil reserves are lost forever in many cases when operating on that theory. Indications are that a length of time varying according to field conditions is required to produce the oil. When attempts are made to push it too fast profitable recovery is drowned out at an early date, resulting in a loss in returns to all concerned. One accounting practice that is greatly in error from an engineering standpoint is that of charging every barrel of oil produced with a share of general office expense and overhead. Generally speaking it is far more reasonable to figure an old lease's economic limit by balancing cash income and salvage value against actual cash expense for each day or month's operation. This gives a truer picture of a lease's value at the end of operations. This gives a longer productive life and higher number of barrels of oil produced.

A water supply for flooding is another vital item which normally increases appreciably the initial investment needed. When a water system is installed it is only good engineering to design it large enough so as to provide a supply for future as well as present development. The water system alone may cost as much as one thousand dollars per acre for the first flood unit, but as additional acreage is added the unit cost will decrease.

Operating costs are relatively high in secondary operations. Unlike new flush fields there is never a time during the life of a project when the reservoir itself will supply the motivating force to bring the oil to the surface. Whether a water flooding project is operated by pumping or by flowing makes little difference. In either case outside energy is supplied and that energy costs money be it supplied at the producer in the form of a jack, rods and working barrel, or at the intake well in the form of increased pressure supplied by pumps at the water plant. The expense of putting water into the ground is also appreciable. Over the life of a project the water cost will normally be between 10 and 20 cents per barrel of oil produced or higher. Add to this a lifting cost of 15 to 30

*Above: New Pumping Well on Old Stripper Lease Under Flood. Well Making 20 Barrels of Oil Per Day.*

*Flood Water Supply Well Delivering 3000 Barrels of Salt Water Per Day to Surface Storage Pond.*

cents per barrel and the total production cost varies from 25 to 50 cents per barrel exclusive of engineering and administrative expense. These last two items may range from five to ten cents per barrel, giving a total of 30 to 60 cents per barrel over and above the cost of initial investigation, acquisition and development. Only those properties showing maximum recoveries approach the lower limits of the above figures. Using an average cost of $1,700 for acquisition, investigation and development and an average productive cost of 45 cents per barrel, an average oil recovery of 2,700 barrels is required to break even with oil selling for only one dollar per barrel. An investment of that sort cannot be considered favorably.

With the price of oil pegged at a sub-normal level and labor and other costs proportionally high the outlook for secondary recovery is bleak. The small operator who owns several hundred acres of potential secondary oil hesitates to put his savings of past years into an investment from which there is little assurance he will recover more than a portion of it, to say nothing of any profit for his efforts. For other operators who themselves lack the capital but in the past have been able to borrow for proposed new developments, there is no place where they can go for help. It is true a few projects have been started in the past year; however, there is no assurance that such development will continue. Some of those projects which were started were based on an anticipated increase in price with the thought that by the time flood production was available a sufficient price to justify the investment would be available. Now that this anticipation has not materialized the operators are prone to close down operations, leaving their money in the ground until a time when they can afford to withdraw it in the form of oil runs. Other operators whose sole business is based on secondary recovery have been forced to continue minor developments in order to maintain a minimum amount of production that will cover overhead and fixed costs in order to hold their organizations together. There is definitely not the increased development warranted by reserves, all because of insufficient price.

In the case of other operations the present low price of oil is tending toward ultimate waste in reserves. Because of the low price, operators have been forced to cut their costs at every turn and in doing so have in many cases taken steps which in all probability will result in reduced ultimate oil recoveries even though the operator himself may come out with a few dollars profit. This is not a healthy condition. At the present time only those properties with the highest indicated oil recoveries can possibly be developed at a fair profit. If all the best properties are drilled up so that the operator completes operations in a given area without going on to those of poorer quality than the marginal and sub-marginal acreage adjoining may never be developed, resulting in a great loss in ultimate oil production.

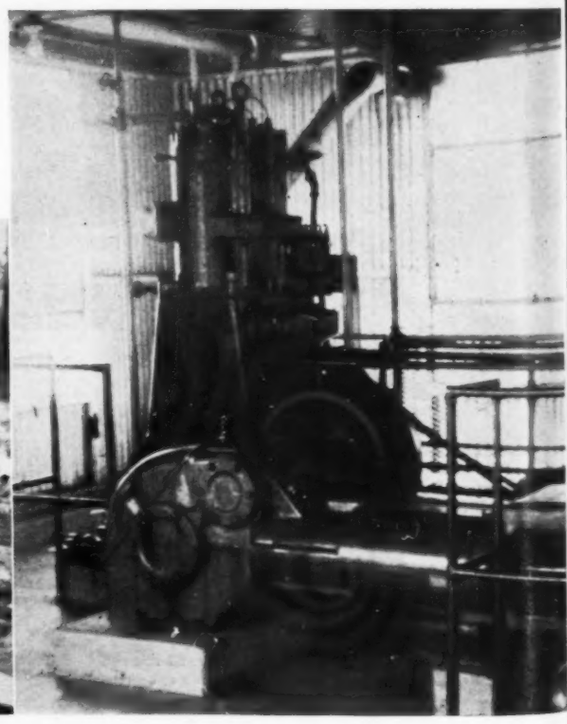
Operators are now being forced to the use of exceptionally wide well spacings in the development of deep sands in order to reduce costs. Here again it may be that the operations will yield a profit. On the other hand, if the price of oil were sufficient to warrant closer spacing it is entirely possible that a greater amount of oil would eventually be produced, adding that much to the country's oil pool and at the same time giving the operator a fair return on his investment.

The shallow stripper area of Eastern Kansas is a good example of the effect of price on recoverable oil. It is estimated that there are approximately 55,000 productive acres in the area representing a recoverable oil reserve of nearly 121,500,000 barrels of oil. This includes acreage with estimated recoveries varying from 1,000 barrels of oil per acre to 4,000 barrels per acre and above. It is further estimated that only 11,000 or 20 percent of the total acreage will yield recoveries of 4,000 barrels per acre or more. It is also likely that little acreage below this quality will be developed under present economic conditions. It follows then that only 44,000,000 out of 121,000,000 barrels could be produced at a profit at today's market. It is also very unlikely that any great percentage of this better acreage will be drilled until the operators can see their way clear to drill some of the poorer acreage on a profitable basis.

In conclusion, the secondary recovery situation may be summed up in this manner: By means of secondary recovery the country's potential oil reserves are increased by approximately 20 percent. The ways and means of producing this secondary oil are known and are available to the industry. The one major item that is lacking is the incentive required to induce operators to put their money into the ground with the hope of getting it back together with a substantial gain. The oil man does not ask to win on every bet but he does like to know that the odds against his winning are not stacked so high that he is beaten before he starts the game. Data from the Bradford field of Pennsylvania, the home of secondary recovery, has shown that in secondary recovery, the same as primary, there is a definite relationship between price of oil and number of wells drilled and barrels of oil produced. It is unfortunate that with the existing great need for this vital raw material the men who are capable of getting it and supplying it to the nation have their hands tied by a group of bureaucrats and political interests.

*Right: Mixing Pond for Fresh Water and Return Salt Water.*

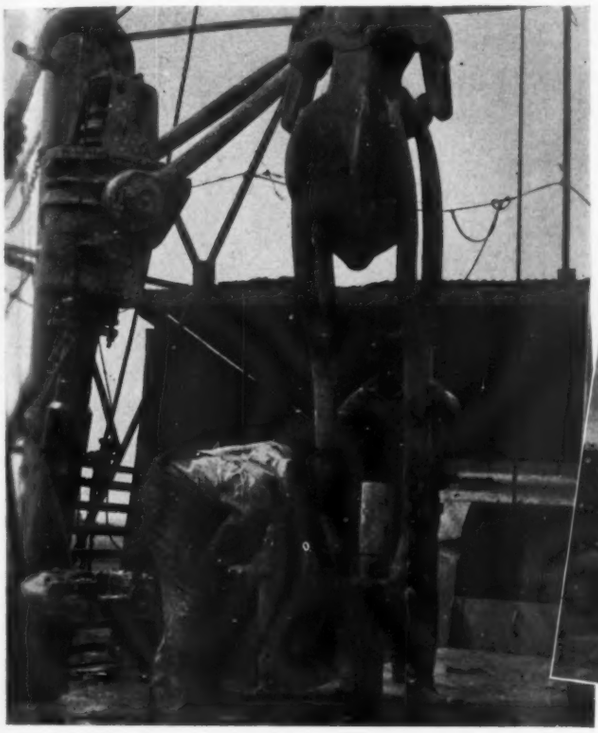
*Below: Gas Engine Driving High Pressure Water Pump.*

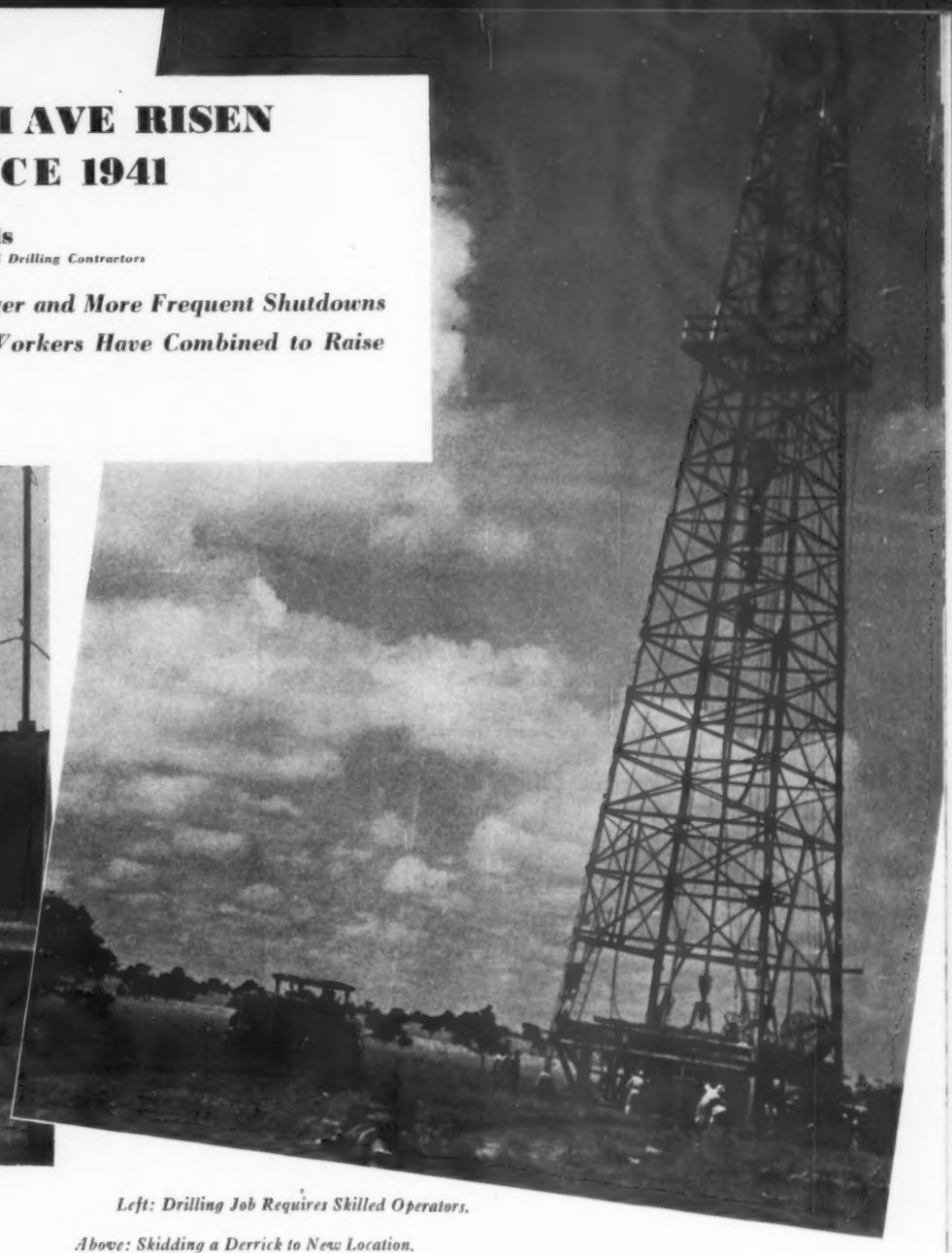


# DRILLING COSTS HAVE RISEN SHARPLY SINCE 1941

**By Brad Mills**
*Secretary American Association of Oilwell Drilling Contractors*

***Heavier Outlay for Wages and Materials, Longer and More Frequent Shutdowns and Necessity of Employing Inexperienced Workers Have Combined to Raise Expense a Third or More.***





*Left: Drilling Job Requires Skilled Operators.*

*Above: Skidding a Derrick to New Location.*

THE three major cost classifications ordinarily considered in drilling a well for oil or gas are (1) labor, (2) materials, and (3) miscellaneous items and services (expense). Drilling costs are effected by many factors, such as location, labor, transportation, formations encountered, weather, shortages, and loss of time between wells. Various intangible factors also enter into the cost picture, particularly during times of stress. These latter influences may appear in the form of lowered drilling crew morale, a tendency toward fear or mistrust between operators and regulatory bodies, or hesitancy on the part of operators to push drilling programs under confusing circumstances.

A drilling crew having the interests of employer and the war effort at heart will drill a well at less cost than a listless, uninterested crew, yet it is difficult to reduce the increased cost to a definite figure in many instances. During normal times continuous drilling operations certainly result in lower operating costs than spasmodic drilling operations, but where shortages of materials and manpower force shutdowns, even the best-planned drilling program may show higher-than-average cost.

The exact increase in drilling costs of March, 1944, over those of September, 1941, are difficult to determine, since basic factors have changed considerably. Where shutdowns from lack of labor and materials were very rare during 1941, they were common during the past year. Next to a bad fire or blowout, a shutdown is perhaps the most expensive time-loser a drilling contractor encounters. Shutdowns are reflected in greater operating costs in every department.

In analyzing the rise in drilling costs during the past two and a half years, it is not easy to separate the various elements so as to show that labor accounted for a certain specific percentage, materials another percentage, and miscellaneous items still another percentage to make up the total increase. Increased labor costs are so tied into "losses from shutdowns" that labor actually becomes a part of the shutdown loss. The fact is that all phases of drilling activity have become more expensive and have combined to bring about a substantial cost increase. Whether "labor", "shutdowns" or other reasons are to be held chiefly responsible is incidental to the main issue.

Costs likewise vary with every set of conditions encountered. One drilling contractor will state that his current costs are 30 percent above those of late 1941; another will insist his costs are up 35 percent over the same period, while still a third will place his cost increase at 40 percent. Each contractor may be correct in his estimate as one operator may be less seriously affected than another by a given set of factors. In many cases where the increase in drilling costs apparently has been entirely too high for a drilling contractor to absorb, but one thing or another has permitted him to continue operations.

Drilling costs do not necessarily increase in

direct proportion to the increase in drilling time. With all factors remaining constant, a type well now requiring 30 days to drill costs 25 percent more than the same well would cost if drilled in 24 days. Current daily operating costs are so much higher than those of late 1941 that any increase in drilling time actually represents a "double" increase in costs. Thus an increase of 25 percent in drilling time may represent a 25 percent increase in former drilling costs, plus the increased daily costs. Current labor costs are considerably higher than those of 1941 because of (1) higher flat rates per hour, (2) additional overtime payments, and (3) longer drilling time on the average well. Such intangible factors as inefficiency of green help and crew morale also increase labor costs.

Until recently the average drilling crew was not paid during short shutdown periods. The acute shortage of skilled workmen has made it necessary to pay crew members while a well is standing cemented, waiting on fuel, or otherwise shutdown for a day or so. The loss of a drilling crew because of a two-day shutdown is more expensive under present conditions than payment of wages during the period, since recruitment of another crew may require a week or more. Such shutdowns are not long enough to justify the lending or "farming out" of the men to other drilling contractors, and the loss must be absorbed through an increased payroll. During short waits between wells it also may be necessary to take care of drilling crews on the same basis.

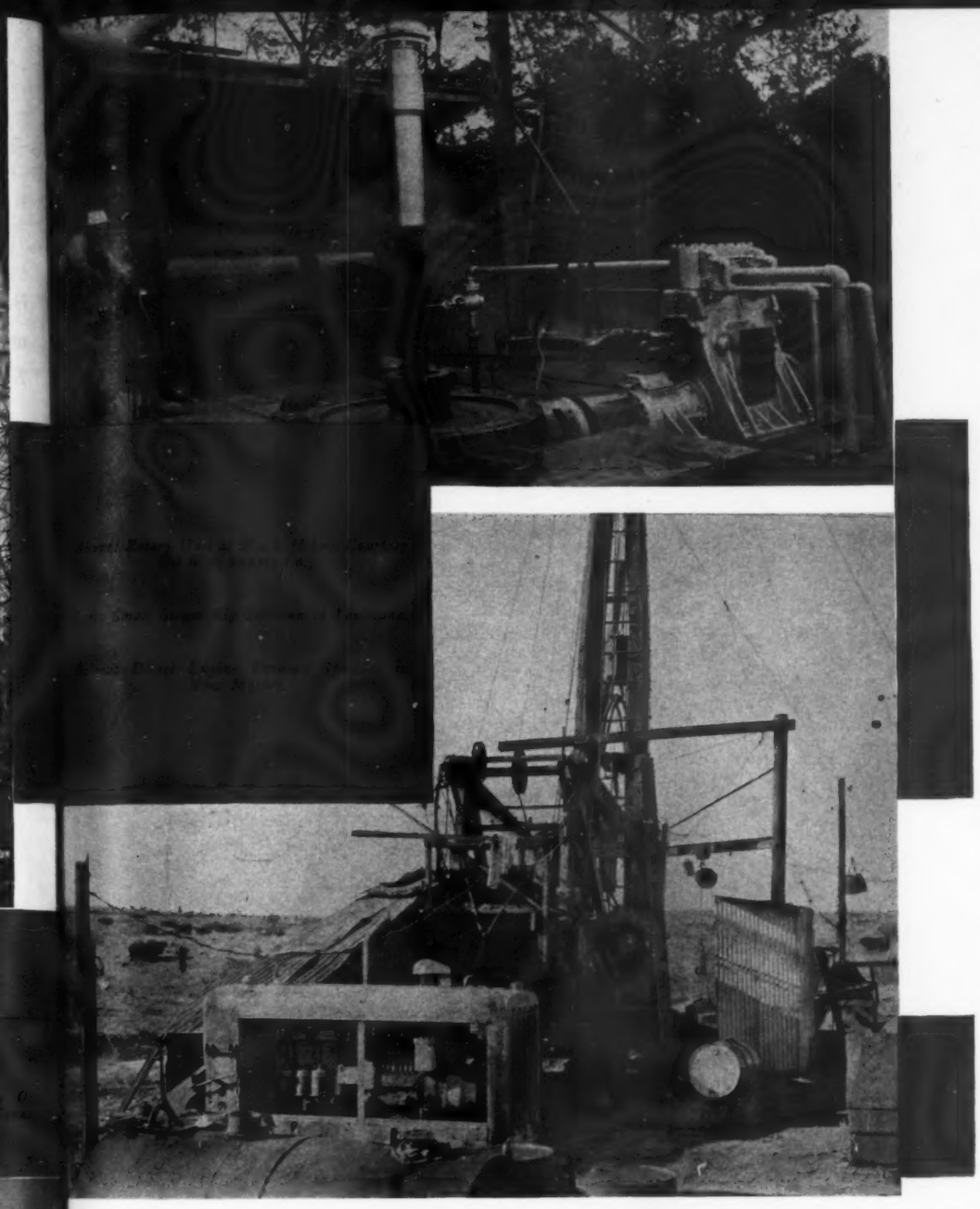
Overtime provisions and longer weekly working hours have become substantial items in labor costs. The doubletime requirement for work performed on the seventh consecutive workday of any workweek adds about six percent to the weekly payroll. In many instances, particularly in isolated areas, crewmen sometimes "double over" by working 16 hours daily, while in some cases 12-hour tours are necessary because of lack of skilled men. Where longer than usual hours are worked, the weekly pay rate increases rapidly.

Green crewmen usually draw as much money as experienced men doing the same work, but they certainly are not as efficient. The drilling industry has trained several thousand men in new jobs since 1941, and many thus recruited are gradually becoming efficient workmen. The training period runs from an absolute minimum of one year for floormen to four or six years for drillers. Drilling contractors, largely through their own ingenuity, have been able to increase the number of actual rotary drilling operations in the United States from about 750 to 1300 during the past year. Such an increase required the training of many new men and greatest possible utilization of available skilled men.

The increase in material costs probably has not affected the overall cost more than has the scarcity of materials. Here again it has been difficult to separate material costs from shutdown costs, but the total increase has been obvious in many ways. The loss of time from shutdowns of every sort has increased steadily as materials, manpower and transportation facilities became scarcer. The increase in shutdown costs usually is in close proportion to the increase in shutdown frequency. The loss of time between wells is a form of shutdown, where drilling operations are held up because of lack of materials, labor or a service of any kind. Shutdowns have increased as much as 30 percent in some areas, although loss of time from this cause never remains constant.

The increase in costs of the miscellaneous items and services (expense) has been pronounced and definite. Transportation costs are much higher than in 1941, due to a shortage of trucks, to the necessity of using unskilled workmen and to general inefficiency in the movement of materials. The truck shortage has resulted in a moving time between wells of 11 days at present, as compared with only three and a half days in late 1941. This 200 percent increase in moving time has resulted in a heavy overall cost increase in drilling activity in every area. Rig building costs are much higher than a comparable service of 1941, in some instances as much as 50 percent. Fuel and water costs also have increased considerably in most areas, as much as 25 percent in some. Miscellaneous items and services have increased in cost in about the same proportion as the overall cost.

Cooperation of producing companies toward establishing a reasonable continuity of operations for drilling contractors has been most helpful in



holding down costs. If such cooperation had not been practiced, the drilling contractor probably could not have continued in business under current conditions.

A year ago the writer stated in an article in WORLD PETROLEUM that the manpower problem was one of the most serious then confronting the drilling industry. It was shown that due to the curtailment of drilling activities in 1942, a large percentage of trained personnel in the drilling industry sought employment in shipyards, aircraft plants and other defense projects, not to mention the heavy loss of skilled men through selective service. Drillers, firemen and floormen made such good workmen that other industries regarded them as semi-technicians and eagerly absorbed them. The exodus brought about a serious labor problem that still exists in the drilling industry. Efforts were made during 1943 to effect the return of many of these men to the drilling industry, where it was evident that such skilled workmen could best serve the war effort as drilling crewmen. Very few men were returned, however, as the shortage of suitable manpower in other industries has made it very difficult to obtain skilled workmen for drilling crews through negotiated transfers. The drilling industry now is operating on an increased cost basis and at reduced efficiency, partly because it was forced to stand by and lose many of its skilled men to other industries during 1942, a period of reduced operations.

The percentage of labor, material or miscellaneous costs to the total well costs varies from place to place and from time to time. Labor usually has been regarded as one-third of the total drilling cost of a well, materials about 45 percent, and miscellaneous items from 20 to 22 percent. All these classifications vary between fields and individual wells, but the labor percentage definitely has increased since 1941. Obviously, the recovery or limited use of casing and other materials in wildcat wells reduces the cost percentage of this classification, while throwing higher percentages into the labor and miscellaneous columns.

It has not been easy for the average contractor to carry on efficiently during the past two years. He stood by during 1942 and saw many of his men go to other industries. Through 1943 he fought to increase drilling operations, despite shortages of both manpower and equipment. The use of many unskilled men has reduced operating efficiency and increased drilling costs on an average of more than 30 percent since 1941. In some areas the rise has been as much as 40 percent. The drilling contractor's attempts to carry on under difficult conditions prove that he still is animated by patriotic motives and clings to his belief in free enterprise.

**WILDCATS—COST BREAKDOWN**

| | Percentages |
|---|---|
| Labor | 42 |
| Materials | 33 |
| Miscellaneous | 25 |
| Total | 100 |

**PROVEN FIELDS—COST BREAKDOWN**

| | |
|---|---|
| Labor | 33⅓ |
| Materials | 45 |
| Miscellaneous | 21⅔ |
| Total | 100 |

**ALL WELLS—AVERAGE COST BREAKDOWN**

| | |
|---|---|
| Labor | 35 |
| Materials | 42 |
| Miscellaneous | 23 |
| Total | 100 |

*NOTE:* Breakdown costs vary sharply from field to field.

**PERCENTAGE INCREASE IN DRILLING COSTS SINCE 1941**

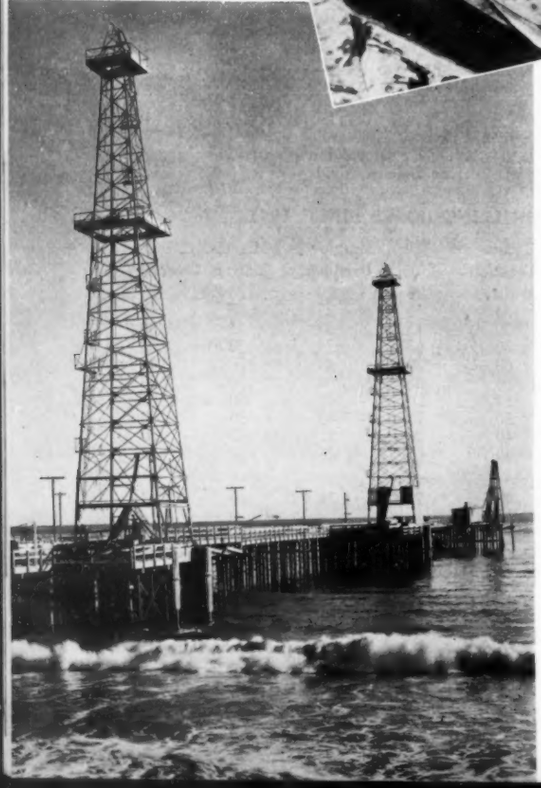
| Operator | Labor | Materials | Derrick | Transportation | Fuel | Shutdowns (Frequency) | Miscellaneous | Overall |
|---|---|---|---|---|---|---|---|---|
| No. 1 | 31 | 20 | 30 | 40 | 25 | 20 | 30 | 28 |
| No. 2 | 32 | 20 | 40 | 35 | 15 | 25 | 35 | 30 |
| No. 3 | 33 | 15 | 50 | 30 | 15 | 35 | 35 | 30 |
| No. 4 | 35 | 20 | 40 | 30 | 15 | 25 | 30 | 28 |
| No. 5 | 40 | 25 | 35 | 60 | 20 | 40 | 50 | 40 |
| No. 6 | 40 | 25 | 40 | 55 | 25 | 40 | 50 | 40 |
| No. 7 | 30 | 20 | 40 | 50 | 20 | 40 | 50 | 33 |
| No. 8 | 40 | 20 | 50 | 50 | 15 | 40 | 50 | 40 |
| No. 9 | 30 | 25 | 40 | 40 | 20 | 25 | 40 | 30 |
| No. 10 | 70 | 15 | 25 | 40 | 15 | 25 | 30 | 32 |
| Average | 38 | 20.5 | 39 | 42.5 | 18.5 | 31.5 | 40 | 33 |

*NOTE:*—The above increases are based on the comparison of drilling costs for wells in February, 1944, with those of similar wells in September, 1941. The increases shown for "labor" include all labor costs and are not the flat increases in labor rates.

*Servicing the Swivel in a California Deep Well.*

*Above: Wells Along the Waterfront, Venice Field.*

*ow: Offshore Wells in the Elwood Field.*



# CALIFORNIA SPURS PRODUCTION TO MEET WAR DEMANDS

**By Read Winterburn**

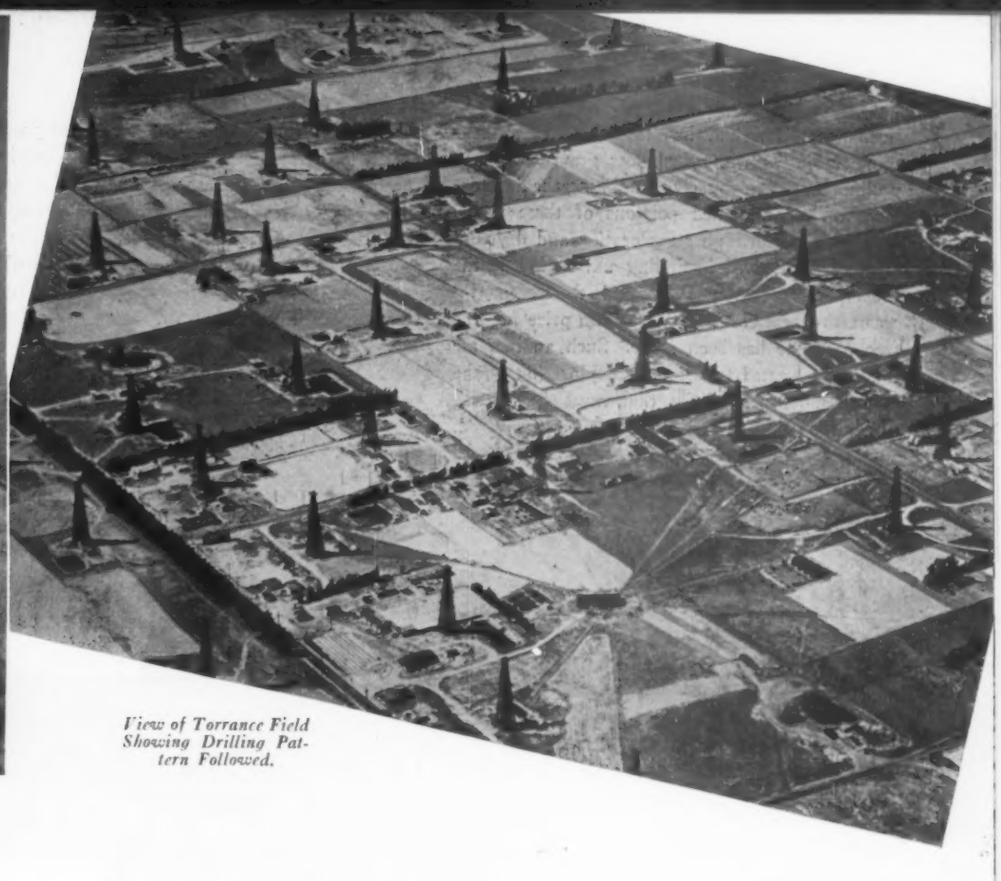
*Chief Engineer, Union Pacific Railroad Co.*

***Despite Inadequate Price, Manpower Shortage and Drilling Restrictions State Has Added to the Number of its Wells and Volume of Production.***

UNPRECEDENTED demand for petroleum products from California as a result of the war has necessitated large withdrawals from stocks during the past year.

In spite of the fact that all fields in the state have been producing at maximum efficient rates since early in 1943, and in spite of the steadily expanding activity in development and exploration which is now taking place, withdrawals from stocks during 1943 indicated average deficiency in crude oil production for the year amounting to about 75,000 B/D. The deficiency for December of 1943, when California production was 792,000 B/D, was 160,000 B/D.

In an effort to keep pace with the tremendous demand, California operators have in recent months greatly increased the number of strings of tools in operation in proven fields and in exploratory



*View of Torrance Field Showing Drilling Pattern Followed.*

work. The initiation of this activity was delayed during 1942 and the early part of 1943 by the restrictions on drilling, designed to conserve steel, set up by PAW (then OPC) in December, 1941.

Conservation Order M-68 resulted in a virtual shutdown of drilling in many of the most important fields in the state. Only 569 oil wells were completed in California during 1942 as compared to 941 in 1941. Expanded activity in 1943 resulted in an increase to 1163 wells.

It is probable that had these restrictions not been necessary, 500 more wells would have been drilled in 1942 and perhaps 100 more in 1943. These additional wells would have increased the present productive capacity of California by about 40,000 barrels per day.

As soon as officials responsible for formulation of regulations governing drilling became aware of the impending shortage, work was started on replacing M-68 with regulations which would permit orderly and effective development and production under the particular conditions obtaining in California fields. Members of the PAW staff, working with industry representatives, have evolved a well conceived set of regulations defining the individual zones in each field and allowing development of each zone as a separate unit on a specified spacing.

However, mere lifting of restrictions on drilling and installation of production equipment did not assure the immediate beginning of the expanded drilling program. Three obstacles remained to be overcome—manpower shortage, material and equipment shortage, and a price structure for crude oil frozen at the level of May, 1941 when all costs were much lower than they are at present.

The manpower shortage proved to be acute when expansion of drilling started. The drain on trained oil field workers had been aggravated by two factors. Great numbers laid off during the enforced lull in 1942 had gone into the armed forces or shipyards and other war industries. A contributing influence was the delay in recognition of the oil industry as an essential war activity with respect to draft deferment of skilled workers.

Effective measures have now been put into effect by the War Manpower Commission on the basis of data submitted by the Industry Committee on Manpower and by PAW. These measures are: first, granting a high position to petroleum production in the list of essential war industries; second, conducting an active campaign to induce skilled oil field workers to return to their former jobs.

During the second half of 1943 when the number of drilling strings was constantly being increased, many wells were delayed in starting because no crews were available. However, it was possible to maintain a steady increase in the number of rigs by return of oil workers from other industries and by hiring inexperienced men. The latter practice, however, is one of the factors contributing to a decrease in efficiency in drilling operations.

During 1943 a shortage in major items of oil field equipment was avoided. This was largely due to the institution of careful forecasts by PAW of future requirements which are used by the War Production Board as a guide in allocation. Salvage of tubular goods has kept demand for new casing and tubing at a minimum.

The most serious equipment shortage which affected the development program was in engines and replacement parts for engines and machinery. This occasioned long delays in many cases. Scarcity of special steels and hard facing has resulted in a noticeable increase in drilling time in some fields due to poorer performance of bits and more drill pipe failures. Deficiency in the number of tool joints available has also caused difficulty.

One noteworthy result of the inadequate price of oil was the large number of stripper wells which were not producing in the early days of the war. Most of the wells in many of the shallow, low-gravity fields of the San Joaquin Valley had been shut in for several years. A revised price schedule, which became effective in 1943, increased the price of low gravity crude and left the higher gravities

The following are the new oil-producing areas discovered during 1943:

| | | | Producing Horizon | | | | Production December 1943 | |
|---|---|---|---|---|---|---|---|---|
| | | | Depth | | | | | |
| Field | County | Sec., T & R | Top | Btm | Age | Formation | No. Wells | B/D |
| Burrel | Fresno | 35–16S–18E | 6484 | 6496 | Miocene | Temblor | 1 | 49 |
| Lanare | " | 22–17S–18E | 6848 | 6855 | " | " | 1 | 55 |
| Pleasant Valley | " | 29–20S–16E | 8940 | 9142 | Eocene | Gatchell | 6 | 1297 |
| McClung | Kern | 4–30S–26E | 7482 | 7518 | Miocene | Stevens | 2 | 275 |
| Sharktooth Hills | " | 24–28S–28E | 2423 | 2435 | " | Vedder | 2 | 243 |
| Tejon | " | 35–11N–19W | 2151 | 2345 | "(?) | Chanac | 2 | 67 |
| Midway—Sec. 6 Pool | " | 6–32S–24E | 2908 | 3100 | Miocene | Maricopa | 5 | 757 |

unchanged. This had the effect of returning large numbers of these marginal, low gravity wells to production and of greatly stimulating the development of the undrilled portions of these fields. In spite of much higher exploration and development costs involved in finding and exploiting the deeper, high gravity fields and the recent increases in these costs, no increase in price for this type of crude has been made. Such an increase could be expected to stimulate exploration of the more remote possibilities that must be investigated if prolific new fields are to be discovered. Certainly no complete solution of these problems had been effected by the end of 1943 but it can be said that a general improvement had occurred. The greatest loss of efficiency in the development campaign at the present time is due to the continuing shortage of engines and replacement and repair parts and the inferior quality of certain items of drilling equipment.

Nearly all of California's production is now coming from fields discovered more than five years ago. Although nineteen new producing areas have been discovered in the period since January 1, 1939, with a few exceptions these new fields have been characterized by thin oil sand sections and comparatively small productive capacity. These nineteen fields produced a total of only 38,000 barrels per day in December, 1943, approximately 4.8 percent of the state's total. The ten fields discovered in the preceding five-year period, 1934 to 1938 inclusive, produced 220,000 barrels per day in December, or nearly 28 percent of the state's total. From this it is apparent that the critical situation of crude supply in California is due largely to the disappointing performance of recent discoveries.

Exploratory activity has been steadily increasing during recent months and has resulted in the discovery of seven new oil fields during 1943. With the exception of the Pleasant Valley Gatchell Sand producing area, none of these seems likely to result in any important increase in productive capacity or reserves. Even the Pleasant Valley discovery offers no promise at present of rivaling any of the larger fields in the state.

Northern California has experienced expanded activity in exploratory drilling which resulted in discovery of eight new gas fields during the past year. While failure to develop reserves of crude petroleum in northern California structures is discouraging, the development of natural gas will indirectly ease the demand for crude to the extent that natural gas can displace fuel oil as an industrial fuel.

With no important new discoveries available to augment production, operators have been forced to turn to other sources in attempts to increase the supply of crude. Production in all restricted fields has been raised to the maximum efficient rate. Large numbers of marginal producers of heavy crude were idle two years ago. Since then a total of approximately 1850 such idle wells have been returned to production.

The development campaign now under way is being conducted principally in the older fields. New wells are being completed in undeveloped portions and recent extensions of these fields.

The shallow, heavy oil areas of the San Joaquin Valley, located on the borders of the basin, which had been relatively inactive in recent years have contributed the major portion of the new wells during 1943.

A total of 817 oil wells were completed in the San Joaquin Valley of which 706 were located in these shallow fields, most of which were discovered from 10 to more than 40 years ago. The remaining 82 San Joaquin Valley wells were distributed throughout the deeper fields, situated toward the center of the valley.

South Belridge, Midway Sunset, and the old Coalinga Field on the west side of the valley and Kern Front, Mt. Poso, Poso Creek and Round Mountain on the east side have accounted for over 90 percent of the shallow, heavy oil producers.

Drilling activity in the Los Angeles Basin was concentrated to a large extent in three fields—Wilmington, Huntington Beach, and Torroance—in which 173 of a total of 244 wells were completed. These 173 wells were all drilled in development of undrilled portions of previously known horizons.

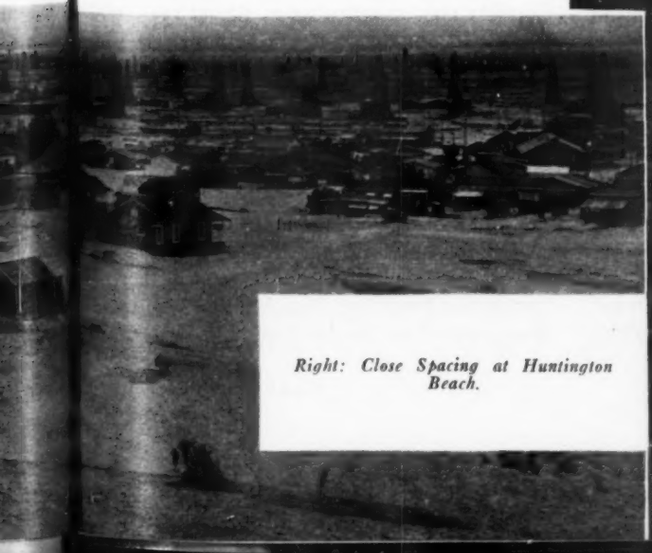
In the Coastal Area two fields were responsible for 47 of the 102 wells completed. These were Ventura Avenue with 25 completions and Santa Maria Valley with 23 completions. The latter field is the only one in California, discovered in the last five years, which had added a substantial number of completions during 1943.

Development in Ventura Avenue is largely in the deep zones, discovered several years ago, development of which was postponed because of restricted demand for crude. Santa Maria Valley development has involved mainly the extension of the area of proven production and drilling of undrilled locations within the proven area.

Prospects for 1944 are that development will proceed along much the same lines as during the past year with the new wells being located in the same fields to a large extent. Should any of the several producing areas discovered during the latter part of 1943 prove extensive, or should important new sources of production be revealed as a result of the expanding exploration program, the contribution of new areas in new completions and production in California will, of course, increase accordingly.

Sufficient undrilled proven locations are available to permit continued drilling at the present rate well beyond the end of 1944. If the present number of active drilling strings is maintained throughout the coming year, a substantially greater number of wells should be completed than the 1163 new-wells added in 1943. Under these circumstances it is expected that productive capacity in California at the end of this year will reach a figure of 850,000 barrels per day.

Considering that the present demand for crude oil of 950,000 barrels per day will probably not decrease for the duration of the Pacific war, it is obvious that supplies to this area must be increased by shipments from sources outside California if stocks are not to be reduced to a dangerously low level. Even the discovery of a prolific new producing area would necessarily be followed by months of development before sufficient productive capacity could be added to noticeably affect the state's total production.



*Right: Close Spacing at Huntington Beach.*

# ★ ★ ECHOES FROM THE WASHINGTON OIL FRONT ★ ★

*By* **W. J. Maddox,** Chief of World Petroleum's Washington Bureau

## More 100 Octane Needed

*Bruce Brown*

As much as has been done in keeping the military supplied with 100-octane, even bigger demands for this vital sinew of war lie ahead. "We need more plants to do the job, and we need them fast," warns Bruce Brown, assistant deputy petroleum administrator.

"We are not today making all the hundred octane our air forces and allies need in order to carry on our increasing aerial offensive against the enemy on both sides of the world," says Brown, "and at the same time build up the operational reserves which every military force must have to mount a sustained attack.

"There has been no lack of oil for the essential needs of any front. And in some theatres the magnitude of petroleum stores staggers the imagination. The breath-taking speed and scope of our drive in the Pacific, delivered simultaneously with round-the-clock and round-the-calendar blows on German war industry, is one indication. But it is still not enough. Allied leaders have promised an aerial smash at Germany that will dwarf even the present fearful plastering. And the European invasion and our main offensive against Japan are yet to begin."

## Mexican Pipe Lines

It seems that it's a bit premature to tag the contemplated pipe lines across the Isthmus of Tehuantepec in Mexico as definitely scheduled projects and to put completion, or even starting dates, on their construction. The idea behind such an undertaking, of course, would be to furnish a means for getting Texas oil to the Pacific, where California is drawing heavily on its reserves to meet military demands in that theatre.

Plans for the projects have been in the pigeonhole since long before the present war, and while they may be pulled out they are still reposing there. The military services continually study all proposed projects that hold possibilities of facilitating the transportation of war materials to battle areas. And among these has been the question of a pipe line across Mexico to move petroleum to the Pacific.

When the supply and transportation problems indicate that the pipe lines are essential, the plans will be taken out and dusted off. Navy gives the assurance that when this time arrives "the appropriate authorities" will make the necessary approaches to other departments of the government to start the pipes rolling. But thus far no such action has been taken. The War Department, the Navy Department, or the Army-Navy Petroleum Board, representing both, have not made any approaches to the Mexican government or to other U. S. government departments.

## Davies Adds Disclaimer

Deputy Petroleum Administrator Ralph Davies added his denial to Navy's that reported construction of pipe lines across Mexico was under consideration. Davies said: "Various alternative methods of moving oil to the Pacific from the Gulf Coast have from time to time been considered by the Petroleum Administration for War. No such project as currently reported in certain newspapers, i.e., pipe lines across the Isthmus of Tehuantepec has been approved by this office, nor are we informed that the Army or Navy are sponsoring anything of the kind at this time".

Davies was perfectly sure that PAW would know of any Army and Navy plans in this direction and said he could not conceive of PAW "not being fully informed by the military as to any such proposal. The Petroleum Administration for War is responsible for supplying the military with its requirements of petroleum and this responsibility obviously embraces the construction of pipe line transportation as it may be required to serve that end."

## Disney Chafes at Bill Delay

*Rep. Disney*

Representative Wesley Disney of Oklahoma voices impatience at the delay of the Senate in taking action on his bill providing for an increase in the price of crude oil which passed the House before its adjournment for the Christmas holidays. As he expresses it, the bill is "sleeping peacefully in committee under the ban of the administration" which the members of the upper chamber are "dutifully obeying". Meanwhile, according to the Oklahoma Congressman, there is an increasing trend toward the concentration of oil property ownership in the hands of major companies as a direct result of the present inadequate price level. Independent oilmen, he says, "who discovered most of the oil resources in the U. S. are being penalized for this effort by their government in the OPA's stubborn, idiotic refusal to permit them to have a price that will enable them to live."

## World Oil Policy

*Wallace E. Pratt*

As for an oil policy, a subject that has jumped to the front and promises much debate during the coming months, Wallace E. Pratt, Jersey Standard vice president, has inserted a few timely paragraphs in the revision of his book "Oil in the Earth". The principles of Mr. Pratt's policy are broad and above the arena of political strife. Here's what he says:

"A wise oil policy for the United States and for the world at large would include a veritable crusade to develop the oil resources of the earth. Most of the world requires far more oil than it has ever had. No industrial nation can exist without oil. Oil turns the wheels of all modern industry. The world's merchant marine floats on oil. Nowhere on earth are standards of living sustained at high levels except where they rest upon cheap transportation and cheap transportation today depends completely on oil. Abundance of oil for every nation is an indispensable preliminary to "freedom from want" for every nation. Without abundant oil there can be no high standard of living; with abundant oil high standards of living can be erected in other countries just as they have been in the United States.

"A wise oil policy for all nations would include the following principal objectives:

"1. The rapid development of the oil resources of the earth to the point where all nations are assured access to adequate supplies "for their common prosperity"; and to the point where proved reserves are of sufficient volume to meet future world needs over a reasonable period.

"2. The opportunity for participation by the citizens of all nations in the development of the oil resources of the earth under the conditions of free enterprise, preserving to all nations, however, perfect freedom to formulate their own legislative control for the development of their own

resources, within the scope of their established philosophy of government and jurisprudence.

"3. The orderly production of oil from the oil fields of the earth without waste, controlling withdrawals of oil uniformly to the optimum rate for each oil field, conserving both oil and reservoir energy, and utmost efficiency.

"4. The efficient distribution ratably from each nation of the exportable surplus of oil, as determined by that nation, among other nations as needed.

"These objectives can best be attained by spreading over the world the same free enterprise that has found and developed so successfully the oil resources of the United States."

The principal barriers to the rapid, complete development of the oil resources of the earth, Mr. Pratt goes on to say, are: "1. Government monopolies which place oil resources in the hands of a government agency and deny to all other citizens any right to explore or develop them. 2. Laws which withhold from foreign citizens the right to engage in exploration or development of the oil resources of a country".

## Poe Leaves PAW

**E.** HOLLEY POE, director of the Natural Gas and Gasoline division of PAW, resigned his position effective March 15th. Like many other active oil men who have labored hard and zealously in Washington during the formative period of war administration, Mr. Poe feels that with the work of his division well organized and operating smoothly he can now return to his former business activities, which he expects to do after a short vacation.

Another recent departure from the Petroleum Administration was that of Lucien F. Craig who had been assistant director of the Division of Petroleum Supply until that division was incorporated in the newly formed Supply and Transportation Division. Mr. Craig came to PAW in March 1943 from Gulf Oil Corporation on the understanding that he would be asked to serve only a limited time but he was persuaded to remain until the reorganization of his division was completed.

## Alaskan Survey Begun

**DEPARTURE** of a reconnaissance engineering party for Alaska marks the beginning of an exploratory program by Navy to determine the usefulness of its Point Barrow petroleum reserve. Navy points out that this is not a drilling party and such an operation would require an appropriation from Congress. However, Navy is preparing to ask the legislators for $1,000,000 for this purpose.

The Alaskan exploration now set in motion is a part of a broader program which Navy has formulated for its petroleum reserves in line with the growing interest in oil as one of the Nation's key problems. Another of Navy's reserves about which relatively little is known is Elk Hills. The only substantial exploration of this reserve has been in the shallow oil zone in the eastern end of the field. The large area to the west and the deeper Stevens zone are unexplored. The Navy has plans there too.

Heading the expedition is Lieut. William T. Foran, who was a member of the geological survey group that made the original survey for the government in 1923 and 1924. Little is known, however, of the potentialities of this 35,000 square mile area at the northernmost tip of Alaska except that oil seepages have been found in several places and the belief is that it holds large quantities of oil.

The party, composed of technical men, will begin at once preliminary work of finding out what the oil resources are. It will study problems of transportation, housing, food, and general working conditions that will confront geological parties and drilling crews Navy expects to send up later in the spring and summer.

## Crowley—PRC Dictator

*Leo Crowley*

**DESPITE** other candidates who have been nominated from time to time as being the "real" czar of Petroleum Reserves Corporation, it looks as if Leo Crowley, Foreign Economics Administrator, is the simon-pure dictator — nominally, anyway. On August 9, 1943, shortly after the President took PRC away from Jesse Jones and gave it to Crowley as director of Economic Warfare, Crowley amended the charter to provide that the Board of Directors shall be appointed by the Director of Economic Warfare, that the charter may be amended at any time by him, and that the corporation shall remain in existence until dissolved by him or by act of Congress. Various Cabinet members, including Secretary of State Hull and Secretary of Interior Ickes, are members of the PRC's Board and owe their jobs to Mr. Crowley—or did the President tell him to appoint them?

## Would Keep Rubber Plants

**SECRETARY OF COMMERCE JESSE JONES** favors keeping synthetic rubber plants intact after the war and having them operated by private enterprise. His purpose: To prevent international cartels from fixing raw rubber production and prices.

## PIPE LINE PROJECT ASSAILED BY INDUSTRY

(*Continued from page 34*)

action to increase the Arabian output as against their output of petroleum and will demand, and probably obtain, increased transportation facilities for their production. It must be remembered that the national revenues of these nearby countries are largely dependent upon the amount of their crude oil which can be currently exported.

(5) The contract assumes, if it does not commit the United States and its nationals to, marketing a large additional amount of oil to be produced from the Persian Gulf fields in competition with other world sources of supply. It will have a serious effect on exports from South America, and United States, and may create ill-feeling with our South American neighbors. If such a result arose from private company action, these countries could not feel aggrieved but when their economics are adversely affected by direct and unnecessary action on the part of the United States government itself, they will undoubtedly feel that they have a real grievance.

(6) It is not necessary for the United States government to build this pipe line. If it is justifiable from a commercial standpoint the companies should, and are able to, build it—if not commercial, it should not be built.

(7) The direct participation by the government of the United States in a pipe line system traversing the territory of three foreign nations can easily lead to international misunderstanding and pave the way to a future war through the involvement of our national honor. Certainly such a project with all of its implications should be submitted for the approval of Congress with ample time for thoughtful consideration.

(8) Any advantages which might accrue to the United States and its people from the construction of such a pipe line by the United States government could all be obtained through the vigorous and sympathetic diplomatic support on the part of our State Department, under established principles of international law of the rights of our nationals operating in foreign fields.

# Foreign Oil Legion

*Charles Van Orman Millikan*

CHARLES VAN ORMAN MILLIKAN, chief engineer of Amerada Petroleum Company, was this year's recipient of the Anthony F. Lucas medal, awarded "for outstanding contributions to engineering in the development and production of petroleum". The presentation was made at the annual dinner of the AIME in New York on February 23.

H. A. KOECHLING, assistant comptroller of the Standard Oil Company of New Jersey, has been promoted to comptroller of the company, and has been elected to its board of directors. Walter Schaefer, formerly comptroller of the Standard Oil Company of New Jersey and assistant comptroller of the Standard Oil Company (N. J.) resigned the former position to give all his time to the latter because of the greatly increased responsibility of the post.

Mr. Koechling joined the Standard Oil Company of New Jersey in 1917 as a clerk and rose through the ranks to become assistant comptroller in 1933.

GEORGE W. WALTON of Clark Bros., Inc., has been elected president of the Tulsa chapter of Nomads for the coming year succeeding P. E. Fitzgerald, the retiring president. Other officers elected are Shep Miers, Southwest Supply Co., vice-president; H. M. Cosgrove, Purchasing Agents Association, secretary-treasurer; A. G. Bailey, Fred E. Cooper Co., sergeant-at-arms; P. E. Fitzgerald, Dowell, Inc. and C. O. Wilson, Oil and Gas Journal, regents.

WINFIELD S. MORRIS of Kilgore, Texas, has been selected as chairman of the Petroleum Section of the American Institute of Mining and Metallurgical Engineers for the coming year. Mr. Morris is vice-president and general manager of the East Texas Salt Water Disposal Company. He succeeds C. A. Warner of Houston Oil Company whose term as chairman ended with the close of the Institute's annual meeting in February.

ARTHUR G. MCKEE & COMPANY, Cleveland, Ohio, designing and construction engineers in the petroleum refinery and iron and steel industries, announce the appointment of Thomas G. Elder as an engineering executive in their petroleum refining division.

Mr. Elder comes to the McKee Company with more than 25 years of continuous experience in petroleum refining operations. During the past three years, he was superintendent of manufacturing for The National Refining Company, in which position, besides directing all manufacturing operations, he also handled the building of new aviation gasoline plant facilities for National in Coffeyville, Kansas. During the war period, he has been active in the petroleum refining war program, having been a member of the Petroleum Industry War Council Sub-committee on postwar adjustments and a member of the American Petroleum Institute on the protection of petroleum facilities.

BEFORE a distinguished audience at the Propeller Club of New York, Rear Admiral Emory S. Land pinned the Merchant Marine Distinguished Service Medal on the blue-coated chest of a modest hero, Commander John Lund, skipper of the oil tanker *S. S. Pan Maryland*. The reason for the medal: The daring rescue of 27 United Nations seamen in a force 8 gale.

IN LINE with projected post-war plans for extension to foreign lands of the regular services of United States air transport operators, Standard Oil (New Jersey) and Socony-Vacuum Oil Company, Inc. have organized a company, with headquarters in New York City through which complete aviation service may be arranged at any foreign air base in the world which may be served by a private company.

The new company, to be known as Intava Inc., further extends the program of providing world-wide service to aviation operators which was initiated in the early thirties by Socony-Vacuum and New Jersey Standard. This program brought together the aviation products supply and distribution facilities of the participating companies, operating through their foreign affiliated companies, and at the same time made their research and technical service organizations available for development of new aviation petroleum products. General supervision of this program was undertaken by a group of aviation executives and technical experts in 1936 under the name of International Aviation Associates, from which the new company's name is derived.

***Officers of New York Nomads and Their Guests at the Monthly Meeting March 13. Left to Right (Sitting) G. B. Flanigan, vice-president, Lt. Col. W. L. Forster, British Merchant Marine Shipping, Frank Keefe, J. H. Baird, (Standing) F. J. Olson, regent, H. B. Book, secretary, Fred Convers, regent, George Woods, W. D. Robinson, treasurer.***

# *"It might have been—"*

We might have lost the war if the American refining industry operated on "trade secrets" instead of inventions that were disclosed and widely licensed, available to all

The petroleum refining art is an open book, written in the records of the United States patent office

Safeguarding the rights of inventors for the limited period of 17 years, constitutes the backbone of steady progress Disclosures by one inventor spur the efforts of many others

American refiners could not have done so good a job so quickly except for our patent system, which protected the results gained through many years of expensive pioneering, research and development Fortunately, the industry was prepared and will eagerly continue to meet any emergency necessary to lick the enemy

Our fighting men will not lack aviation gasoline or other vital oil products on any front

| | |
|---|---|
| CATALYTIC CRACKING | HYDROFORMING |
| REFORMING | DEHYDROGENATION |
| HYDROGENATION | POLYMERIZATION |
| ALKYLATION | UNISOL TREATING |
| ISOMERIZATION | RETREATING |
| THERMAL CRACKING | POLYTREATING |

SWEETENING

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Petroleum Process Pioneers
For All Refiners

*The Refiners Institute of Petroleum Technology*

# REPORT ON PETROLEUM RESERVES

THE American Petroleum Institute's Committee on Petroleum Reserves has issued its annual report showing the status of oil reserves in the United States as of December 31, 1943.

The estimates in this report, as in all previous reports of this Committee, refer solely to proved or blocked-out reserves of crude oil (including condensate) known to be recoverable under existing economic and operating conditions. Therefore, they do not include any estimate of:

(1) Oil under the unproved portions of partly developed fields;
(2) Oil in untested prospects;
(3) Oil that may be present in unknown prospects in regions believed to be generally favorable;
(4) Casinghead gasoline extracted at natural gasoline plants in moderately low-pressure fields;
(5) Oil that may become available by secondary-recovery methods from fields where such methods have not yet been applied;
(6) Oil that may become available through chemical processing of natural gas;
(7) Oil that can be synthetically recovered from oil shale, coal, or other substitutes.

The committee estimates that the proved reserves of crude oil in the United States, as of December 31, 1943, amounted to 20,064,152,000 barrels. This estimate is derived as follows:

| | | Barrels |
|---|---|---|
| Total proved reserves as of December 31, 1942 | | 20,082,793,000 |
| Extensions and revisions during 1943 | 1,202,368,000 | |
| New reserves (new pools) discovered in 1943 | 282,418,000 | |
| | | 1,484,786,000 |
| Total proved reserves of Dec. 31, 1942 and new proved reserves added in 1943 | | 21,567,579,000 |
| Subtract production during 1943 | | 1,503,427,000 |
| Total proved reserves as of Dec. 31, 1943 | | 20,064,152,000 |
| Decrease in reserves since Dec. 31, 1942 | | 18,641,000 |

**Estimated Proved Petroleum Reserves in the United States**

(Thousands of barrels of 42 gals. each)

| | Proved Reserves (December 31, 1942) | Changes During 1943 | New Reserves Discovered in 1943 | Production During 1943 (estimated) | Proved Reserves, Dec. 31, 1943 |
|---|---|---|---|---|---|
| Arkansas | 300,026 | 21,995 | 2,536 | 27,628 | 296,929 |
| California | 3,195,846 | 408,993 | 16,170 | 284,186 | 3,336,823 |
| Colorado | 39,443 | 7,996 | ..... | 2,328 | 45,111 |
| Illinois | 306,778 | 65,803 | 4,226 | 82,185 | 294,622 |
| Indiana | 31,773 | 4,258 | 272 | 5,264 | 31,039 |
| Kansas | 686,975 | 19,772 | 45,352 | 106,247 | 645,852 |
| Kentucky | 34,653 | 4,650 | 3,815 | 7,928 | 35,190 |
| Louisiana | 1,442,126 | 111,984 | 53,491 | 123,775 | 1,483,826 |
| Michigan | 63,843 | 6,187 | 5,900 | 20,682 | 55,248 |
| Mississippi | 40,897 | 14,397 | 2,468 | 18,890 | 38,872 |
| Montana | 85,558 | 30,123 | 200 | 7,824 | 108,057 |
| Nebraska | 2,177 | 523 | ..... | 654 | 1,000 |
| New Mexico | 677,497 | 13,801 | 1,140 | 38,457 | 653,981 |
| New York | 54,395 | 41,180 | ..... | 5,050 | 90,525 |
| Ohio | 35,021 | 600 | 1,527 | 3,305 | 32,643 |
| Oklahoma | 968,927 | 12,194 | 50,524 | 123,027 | 908,618 |
| Pennsylvania | 153,118 | ..... | ..... | 15,795 | 137,323 |
| Texas | 11,545,727 | 283,823 | 88,969 | 593,565 | 11,324,954 |
| West Virginia | 47,187 | ..... | ..... | 3,348 | 43,839 |
| Wyoming | 370,572 | 156,325 | 5,728 | 33,241 | 499,394 |
| Miscellaneous | 254 | ..... | 100 | 48 | 306 |
| Total United States | 20,082,793 | 1,202,368 | 282,418 | 1,503,427 | 20,064,152 |

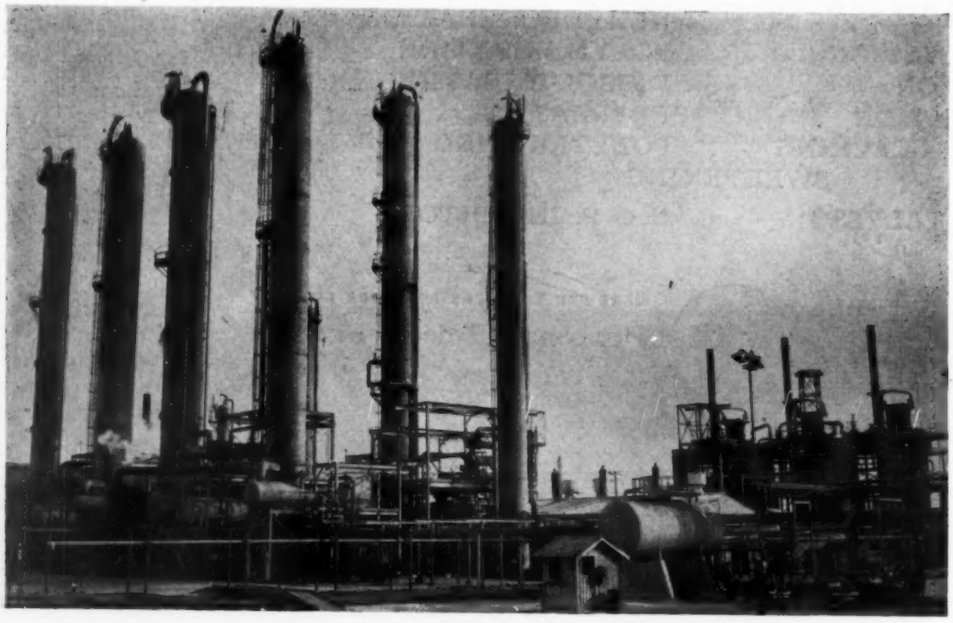
These figures are the totals of the columns shown in the Table I where the details are recorded by states. In column 1 of this table are the estimates of proved reserves reported by this committee as of December 31, 1942.

In column 2 are listed, for each state, the proved reserves added by extensions of pools only partly developed on January 1, 1943, and also revisions of proved reserves where increased knowledge of sand and recovery conditions made changes in earlier estimates necessary.

In column 3 are listed the proved reserves discovered in new fields in 1943.

The production of crude oil during 1943 is shown in column 4. These production figures have been deducted from the sum of column 1, 2, and 3 to obtain the estimated proved reserves as of December 31, 1943, shown in column 5.

# SHELL'S WEST COAST TOLUENE PLANT



SINCE December 1942 the big toluene plant of Shell Oil Company at Wilmington, California, first to be erected in the West, has been turning out this essential ingredient of munitions required for prosecution of the war. Today its output, every twenty-four hours, is sufficient to fill 700 giant block-busters. Only recently, however, have the military authorities been willing to have information regarding the plant appear in print. In lifting the ban Col. K. B. Harmon, district chief of Army Ordnance, wrote: "I am very pleased that we are now authorized to permit the newspapers and the radio to tell the public of the wonderful war production job that you of the Shell Oil Company are doing—and have been doing for many months past—at your Wilmington toluene plant. Your company has been consistently ahead of schedule, both in the construction of your plant and in the production of toluene."

The plant employs a special process developed by the Shell Company for synthesizing toluene from petroleum. It was erected in record time, without recourse to government funds, at a cost of $4,800,000.

# Team-work job gives allied air-fighters big edge

*A tribute to the thousands of patriotic workers who have built and are manning our aviation gasoline plants.*

**STANDARD OIL COMPANY (INDIANA)**

● TWO YEARS AGO the armed forces called on the petroleum industry to increase production of 100-octane aviation gasoline to fuel the world's mightiest air force then in the making. It was no easy task. It meant building more than a hundred great new units, converting many old ones.

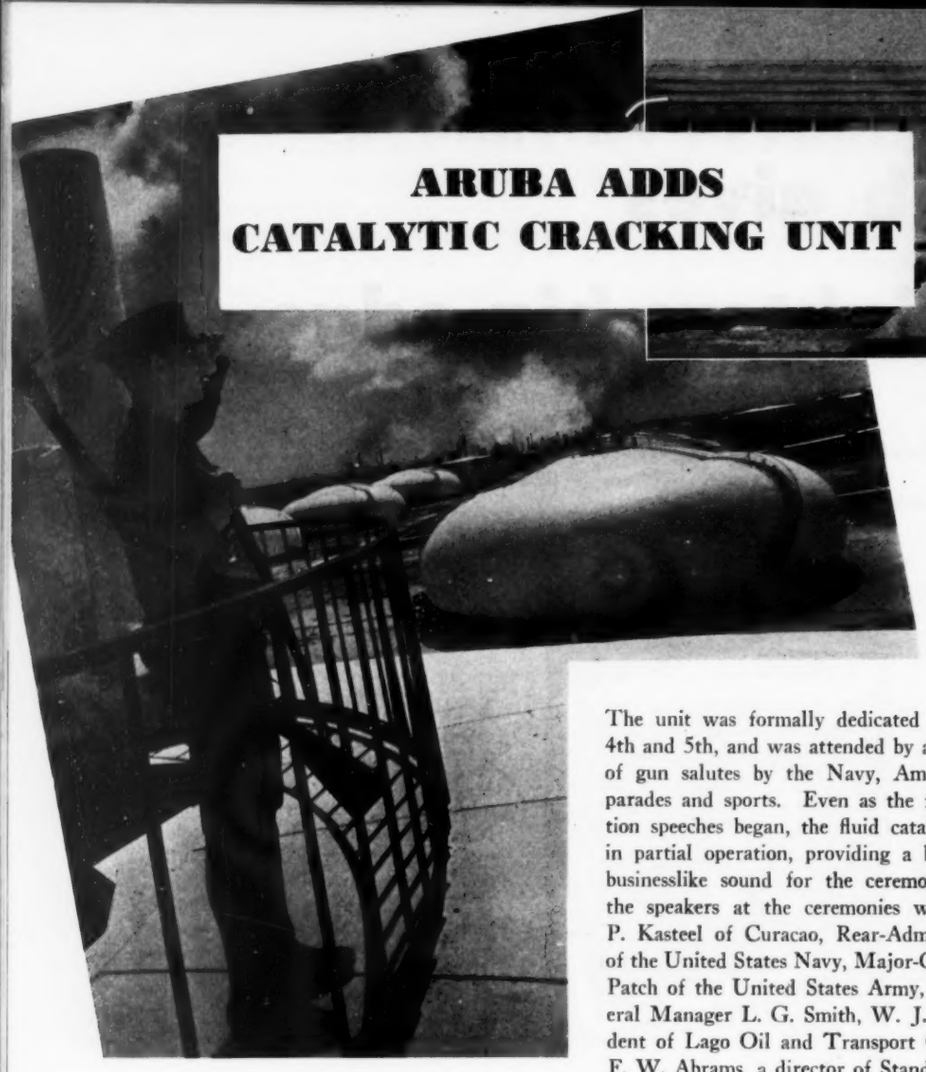
Thanks to the scientists, engineers, builders, and workers, the job is nearly done. Production will soon be more than ten times what it was when we went to war. A great stream of the dynamic stuff which gives our airmen the edge over their enemies is already flowing to the battle fronts. Adolf and Tojo will never be able to match it.

To Standard of Indiana and its subsidiaries was assigned a major role in this great program. We take off our hats to the thousands of construction workers who turned blueprints into operating units, to the process workers who today are bringing production up to the point that our plants alone will soon be making *enough 100-octane gasoline to power a 1000-bomber raid on Berlin every other day.*

The men responsible for this achievement can have the satisfaction of knowing it is one of the important steps in America's war production program—destined to be one of the deciding factors in the final victory.

*Oil is Ammunition . . . Use it Wisely. Buy more War Bonds.*

# ARUBA ADDS CATALYTIC CRACKING UNIT



*Above: New Marine Office of Lago Oil and Transport Company.*

*Left: On Guard at Aruba.*

*Right: Rear-Admiral Chandler USN at Formal Dedication of New Unit.*

THE great refinery of the Lago Oil and Transport Company Standard Oil Company (N. J.) on the Caribbean island of Aruba was generally regarded, before the war, as the world's largest petroleum refinery from the standpoint of throughput. As might be anticipated from its strategic location close to the rich oil fields of Venezuela, it has occupied an important place as a major war weapon of the United Nations.

While the full story of Aruba at War must await the return of peace for its telling, it may be said now that Aruba's streams of petroleum products, ranging from 100-octane aviation gasoline to fuel oil for Navy combat vessels and for merchant ships, have been and are now high on the list of the flood of munitions with which the Axis is being beaten down.

The improvement of Aruba's refining facilities designed to meet the special requirements of the war began in the early days of the present conflict and has continued without let-up. Typical of what has been going on behind the screen of wartime secrecy was the completion last December of a huge fluid catalytic cracking plant. This unit greatly increases Aruba's output of aviation gasoline, and its importance to the war effort is perhaps reflected by the extent of the attention given the ceremonies surrounding its completion.

The unit was formally dedicated on December 4th and 5th, and was attended by a full program of gun salutes by the Navy, American Legion parades and sports. Even as the formal dedication speeches began, the fluid catalytic unit was in partial operation, providing a background of businesslike sound for the ceremonies. Among the speakers at the ceremonies were Governor P. Kasteel of Curacao, Rear-Admiral Chandler of the United States Navy, Major-General Joseph Patch of the United States Army, Aruba's General Manager L. G. Smith, W. J. Haley, President of Lago Oil and Transport Company, and F. W. Abrams, a director of Standard Oil Company (N. J.).

The aviation gasoline potential at Aruba has been increasing gradually since 1938, and with the new fluid catalytic cracker supplementing previous installations for polymerization, isomerization and alkylation, Aruba is now in a position to take on even more of the petroleum munitions load than it has borne in the past.

The erection and placing on stream of the new fluid catalytic cracker was accomplished in record time despite war-time shipping and transportation difficulties, material and labor shortages, and black-out conditions. All building above the foundation had been done since March 1, 1943, and improvements were made during construction.

Among the interesting side lights of the all-out effort made to complete this unit is the fact that stevedores in Aruba unloaded more cargo for the plant in less time than at any similar interval in the refinery's history, sometimes as much as 10,000 tons awaiting their handling at one time. Perhaps typical of the whole tenor of the effort is the fact that one cargo ship started loading Lago construction material for Aruba just seven days after being launched.

Typical too of the construction problems was one encountered by the builders of a new powerhouse associated with the unit; while excavating at the edge of a lagoon 18 feet below sea level, the lagoon had to be kept dry for pouring the concrete and for weeks 40,000 gallons of water a minute were pumped out of the porous coral area.

Aside from the strictly operational or processing problems which have been brought to Aruba by the war, many others affecting the lives of the local population have also arisen, most of which are similar to those experienced by others in critical war zones where black-outs, rationing, shortages of one thing or another are part of the daily routine. The entire island of Aruba was under total black-out during almost the entire time of the construction on the new unit.

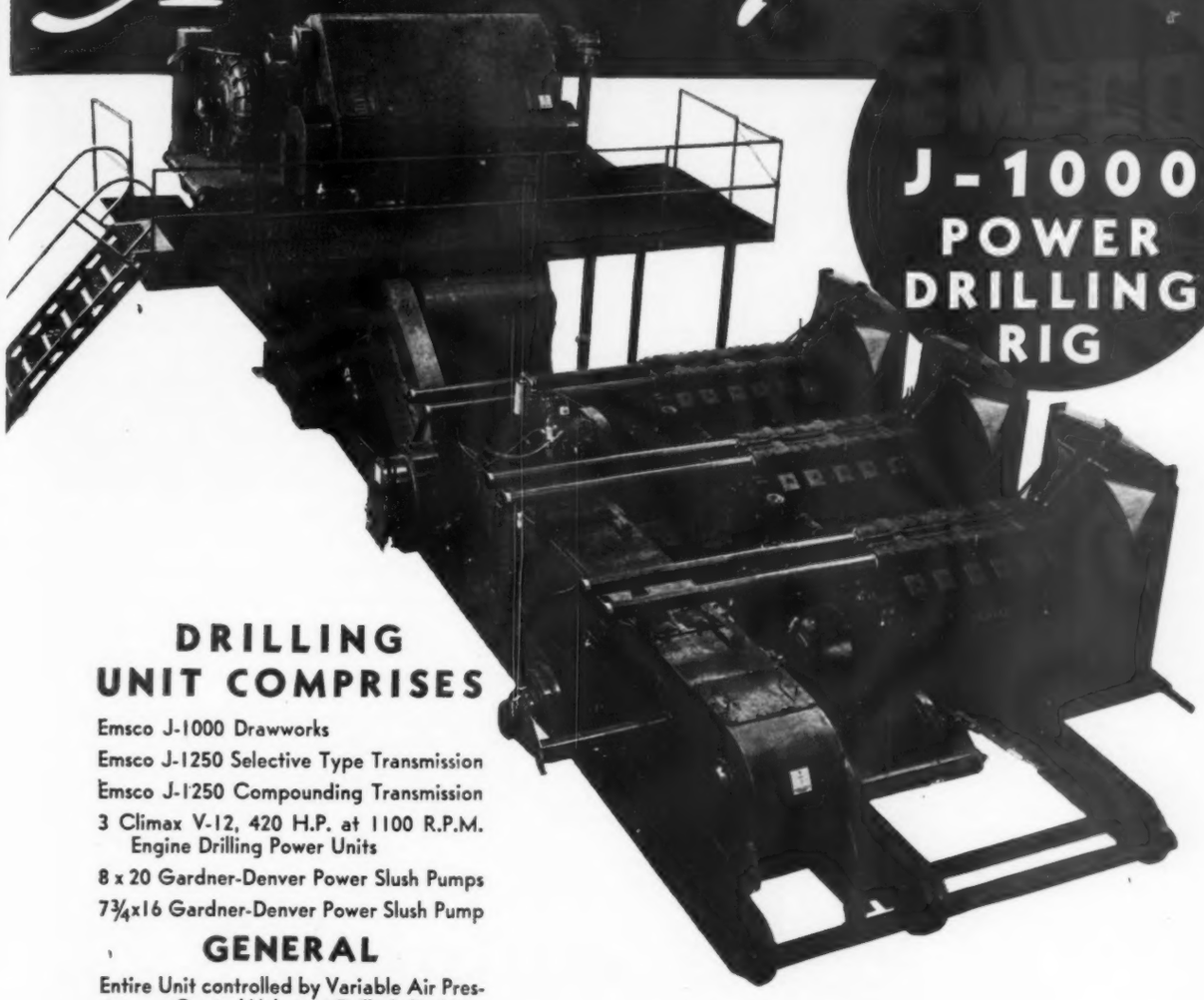
Most residents have equipped their living quarters with means of ventilation while complying with the regulations on light visibility. Car owners are allowed only a small amount of light showing from headlights and tail-lights, necessitating extra caution on the part of both drivers and pedestrians. Since Aruba is a military base, movements in certain areas are of course restricted, particularly after dark. Mail, photographs, and movie films are censored. However, the sole restriction on photography is that no camera may be taken into the refinery, and neither military nor harbor installations may be photographed.

Aside from these war-time problems, however, life on the island has not changed greatly from the pre-war picture insofar as the peculiar problems and practices imposed by the arid and isolated nature of the island are concerned. As has always been the case since the operations were first initiated in 1925, fresh water must be provided by distillation of sea water and by importation in special tankers.

Practically all foodstuffs must be imported, and Lago has continued to maintain the extensive service facilities necessitated by the undeveloped nature of the island, including complete hospital facilities and schools for the children of the employees.

# *Announcing the*

## J-1000 POWER DRILLING RIG



### DRILLING UNIT COMPRISES

Emsco J-1000 Drawworks

Emsco J-1250 Selective Type Transmission

Emsco J-1250 Compounding Transmission

3 Climax V-12, 420 H.P. at 1100 R.P.M. Engine Drilling Power Units

8 x 20 Gardner-Denver Power Slush Pumps

7¾x16 Gardner-Denver Power Slush Pump

### GENERAL

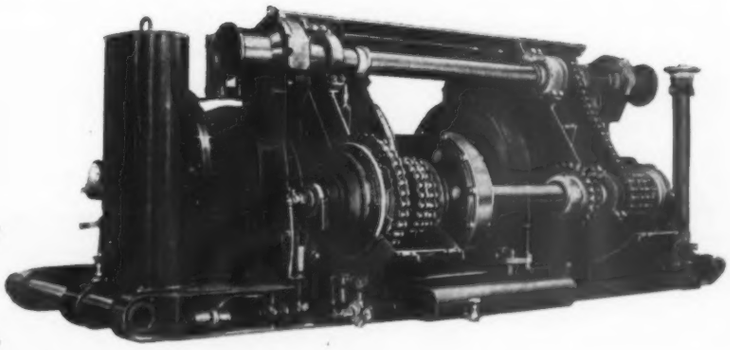
Entire Unit controlled by Variable Air Pressure Control Valves at Driller's Position.

6 Hoisting Speeds, 3 Rotary Speeds, and Herringbone Gear Reverse.

All Chain Drives Pump Pressure Lubricated.

Stair-step Drive from Compounding Transmission which eliminates the necessity of Engine and Transmission Substructures.

▲



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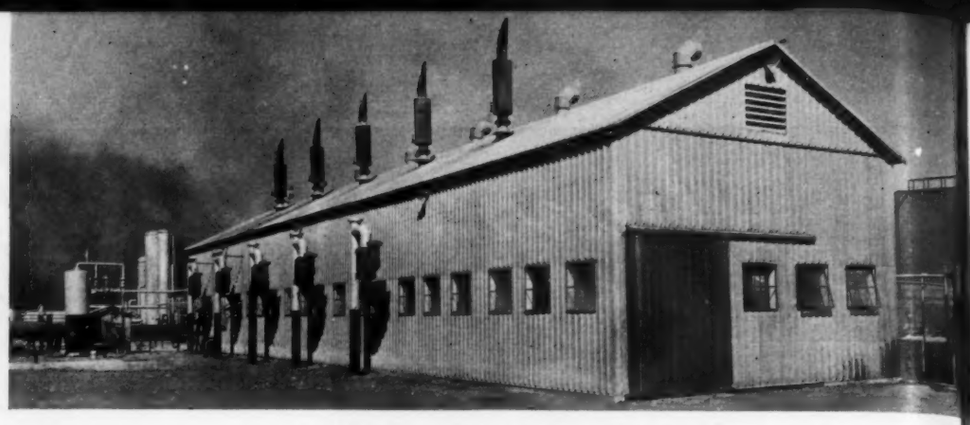
# CONTINENTAL

SERVING THE OIL AND GAS INDUSTRY

# PREFABRICATED BUILDINGS Will Aid Rapid Development Ahead of the Oil Industry



*Typical Building Housing Compressor Station.*

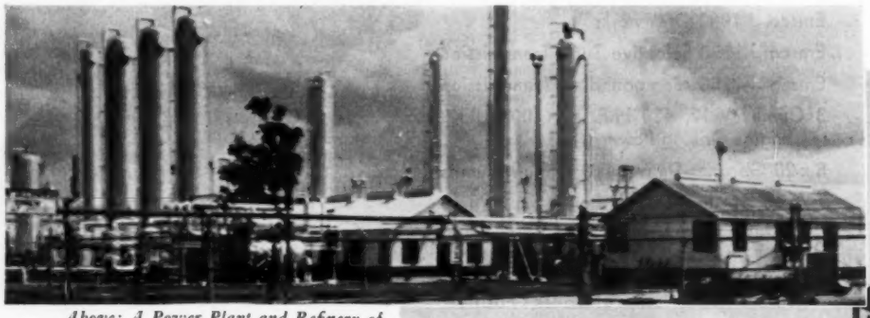
THERE are many uncertainties surrounding the course of the oil industry after the war but one thing is definitely certain. The demand for petroleum products is going to be greater than ever before. As a consequence the hunt for oil is going to assume a new intensity and the development of known fields will be pushed with all possible speed.

In the United States the abnormal requirements rising out of the war will subside but military needs will remain high and the pent-up demands of the civilian population will rise beyond previous levels. The fact that the country has been drawing on its reserves faster than it has been adding to them will call for a lot of drilling and increased attention to recycling projects and all measures of secondary recovery.

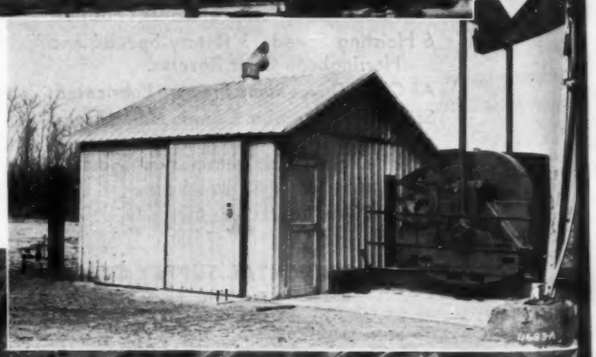
One noteworthy effect of the war has been to impress upon people in every part of the world the vital importance of oil as it never has been realized before. Every country that possesses oil resources will insist that they be developed without delay. Every government that has even a hope that petroleum may be found within its territory will be eager to determine whether this hope has a substantial basis. For four years the normal progress of oil production has been held back by lack of the skilled workers and the machinery to carry it forward. Not only that but billions of dollars worth of installations have been destroyed and the task of replacing them will be a huge one extending over many years.

Nobody who has studied the situation believes that there will be any lack of jobs for skilled oil industry workers after the war or any lack of customers for the manufacturers of oil field machinery and supplies. The problem before the latter will be to turn out equipment fast enough to satisfy the call for it because it is clear not only that the demand for it will be great but that everybody will want it in a hurry. In this connection the war will prove to be helpful because it has brought about a great expansion of facilities for the production of time and labor saving machinery and of prefabricated buildings which will eliminate much of the preliminary work that attends industrial operations in new areas. During the war many plants have been located in previously unbuilt areas and have been provided with prefashioned structures delivered in sections and assembled in a fraction of the time that would have been required to erect them from locally produced materials even if the latter had been available, which usually was not the case.

The oil industry for many years has been a large user of prefabricated buildings and has found that for many purposes they are superior to any other kind obtainable. In undertaking development in a new section there always is a question as to what the results will be and how long the site selected will remain in use. There is an obvious advantage in using a type of building that can be easily dismantled and removed to another location. In many places, particularly in the tropics where much future oil activity is certain to take place, steel buildings, impervious to the destructive influences of weather and of insect attacks, are the only kind that will withstand the conditions that have to be met. Offices, warehouses, machine shops and other buildings which contain valuable records or equipment are now almost invariably of metal construction. Formerly prefabricated buildings were structures of relatively small size but experience has shown that buildings covering thousands of feet of ground area can be constructed far from the site where they are to be used quite as readily as can the furniture or the machinery that is to be used within them. Some of the many types of such buildings that are used by oil companies to serve their special needs are shown in the accompanying illustrations. Such buildings, it is safe to say, will appear in increasing numbers during the next few years in every part of the world where oil is being produced and will prove an important factor in contributing to the rapid development that will be demanded of the industry.



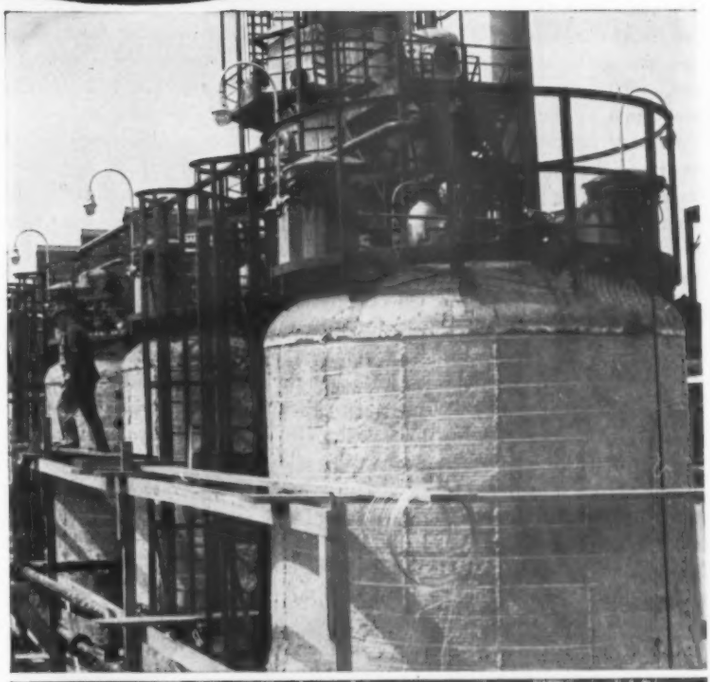
*Above: A Power Plant and Refinery of Prefabricated Construction.*

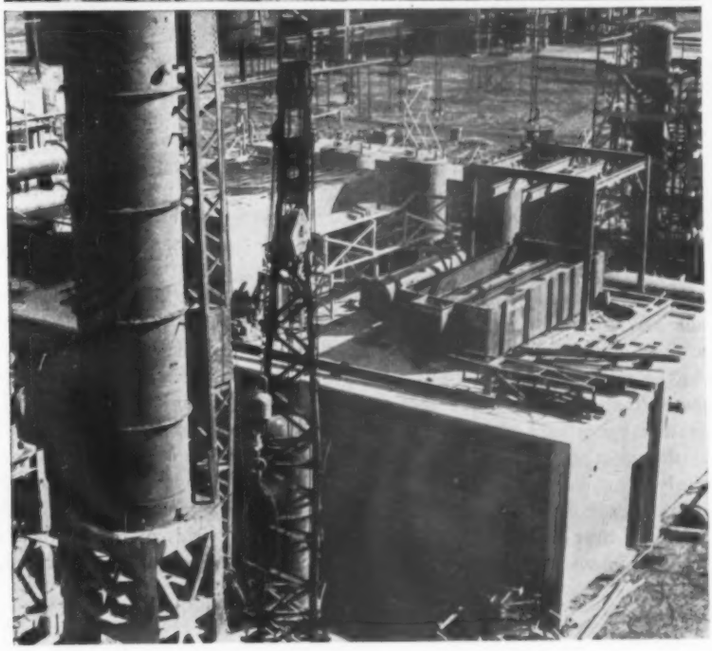


*Right: This Small Building Shelters the Engine Pumping a Texas Well.*

*Below: Light and Roomy Interior of a Prefabricated Compressor Plant.*

# WHAT GOOD ARE PROMISES WITHOUT PERFORMANCE?





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# WHERE SHALL WE LOOK FOR OIL?

IN THE discussion that has gone on during the past year regarding the present position and especially concerning the future of the American oil industry, great stress has been placed upon the declining rate of discovery. It is pointed out that for the past five years the estimated additions to known reserves through the location of new fields have failed to equal withdrawals year by year, that the fields discovered have become progressively smaller and that a point has been reached where not even the extensions of existing fields are sufficient to offset the rising rate of production.

All this is true enough and it presents a condition of grave import not only to those who are directly engaged in oil operations but also to the national welfare and industrial progress so largely dependent upon the availability of petroleum products. As a result of the emphasis placed upon the slackening volume of discoveries the conclusion appears to have been reached in many quarters, including some official circles that oil production in the United States is destined for a period of progressive decline and that from now on it will be necessary to look to foreign lands for an increasing proportion of the nation's petroleum requirements or to resort to substitutes which are obtainable but only at greatly enhanced cost.

Nobody can say positively that this picture is overdrawn. The experience of three quarters of a century of exploration supports the oft-repeated assertion that the only conclusive proof of the presence or absence of oil in a given locality is the test of the drill. Nor does a single dry hole answer the question for many a persistent wildcatter has brought in good production in locations which others had abandoned as hopeless. Many times in the past the country has been warned that it was approaching the end of its oil resources but each time fresh discoveries have intervened to turn the scale and to raise the level of known reserves to a new high point. It cannot be assumed that history will go on repeating itself indefinitely but neither is it safe to conclude that no more great fields will be uncovered.

The plaint sometimes heard that no promising areas on which to drill are left in the United States becomes somewhat ridiculous in view of what the geologists can tell us. To be sure these students of the earth's subsurface seldom are able to state positively that oil will be found in a certain spot. But they are able to say with reasonable assurance that the formations existing within a given area are such that they may contain oil. As the result of surveys already made it is estimated that nearly half the area of the United States is potentially oil bearing and that only the smaller portion of this has been explored extensively. Not unnaturally drilling tends to follow paths already blazed and to concentrate on areas relatively near to those in which production already has been found.

One answer to the question "Where Shall We Look for Oil?" is that we must look for it in places where it has not been known heretofore. Among 1943 discoveries was one in Florida where oil was found at a depth of something over two miles. A single well does not prove the existence of an important field but in this case it will stimulate further exploration in the southeastern states bordering the Gulf, a district that has long been marked by geologists as potentially oil bearing. Another area in which exploratory drilling is being carried on, thus far without attaining commercial production but still with possibilities encouraging to further effort, is the great plains district of the Northern states between the Mississippi and the Rocky Mountains. Here is a region which many geologists have favored as containing formations adapted to the entrapment and retention of petroleum. Other districts embraced within the Rocky Mountain area have been left unexplored because of their distance from markets and their lack of transportation facilities. At a broad estimate there remain at least a million square miles within the United States which can be regarded as presenting production possibilities worth investigation but to which no adequate exploration has been applied.

Another answer to the question of where the search for oil should be directed is that we must look for it in areas that already are producing—but look deeper. Of the wells credited as discoveries in 1943, some 25 percent or more opened new horizons in fields which had been yielding oil for years past. In the early days of the industry and indeed until the recent past the discovery of a prolific pay was accepted as defining the depth of the field and drilling was concentrated on following the course of that particular formation. With advances in methods of underground survey, however, and with improvements in equipment permitting deeper exploration, it has been found that oil exists in a number of distinct strata, from two to half a dozen or more, lying at different depths. The possibilities of multiple zone production have only begun to be developed and they suggest that interesting results may follow from new drilling in fields earlier abandoned as being worked out. Nobody believes that the possibilities of deep drilling have had more than a preliminary test or knows how far beneath the earth's surface oil may be found to exist.

Not all the additions to the nation's oil resources will come from discoveries made by the drill. Some of the most important will emerge from research laboratories and from studies of the chemical nature of oil. It was during World War I and at a time when, quite as today, alarm was being expressed over the probable early exhaustion of the oil supply that the cracking process entered the picture. As a result of the higher yields of the products most in demand obtained through the general adoption of this process billions of barrels of oil have been saved as compared with the quantities that would have been required without this improvement in the refining art. This is a saving that is equivalent to the finding of these billions of barrels underground.

Although it is true that discoveries of oil in the United States have not kept pace with the growth in demand for petroleum products during the past few years it does not necessarily follow that this same relationship will continue into the future. Several factors have contributed to discourage the sort of pioneering that led to the development of some of the great fields of earlier days. Chief of these is the fact that the chance of realizing large profits from drilling in untried territory, or even of getting back the money spent in such ventures, has become too remote to make the risk attractive. Virtually everything required for exploratory drilling—leases, tools and machinery, wages—has risen greatly in cost. Meanwhile the price of oil by government edict has remained fixed at the low level of 1941. Over a period of many years there has been a fairly constant relationship between the price of oil and the extent of wildcatting. As the price moved up because of rising consumption or a threatened future scarcity, activity in the field of exploration increased. When the bringing in of big flush production sent crude prices plummeting the search became less vigorous. The discrepancy between possible returns and rising costs has been greatly increased by the artificial restriction placed upon the prices of crude and products. This presumably is a temporary handicap, the removal of which will restore the normal incentive to exploration. Other difficulties arising from the war such as the scarcity of skilled operators and a lack of equipment may be expected to disappear with the ending of the world conflict. One change, however, is likely to remain in effect.

In the past many important discoveries were made by professional wildcatters—independent drillers whose mode of procedure was to assemble a block of leases and then to finance the drilling of one or more wells by selling part of the property or shares in the enterprise, usually to small investors who were willing to risk a few hundred or a few thousand dollars on the chance of a lucky strike.

Today that form of operation is hampered by the difficulty and cost of obtaining sufficient acreage and by the compulsion which the operator who would sell shares in his undertaking is under of filing applications and obtaining approval from the Securities and Exchange Commission in Washington. This involves legal costs and processes with which the average wildcatter is unfamiliar and which he is loath to undertake. In the future it seems probable that exploratory activity will depend increasingly upon major oil companies which may mean that it may be conducted more conservatively but perhaps ultimately more thoroughly.

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# WORLD PETROLEUM ABSTRACTS

**Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing with Technical and Economic Aspects of the Petroleum Industry—Edited by Dr. O. W. Willcox.**

## GENERAL

**Criteria for determining an oil field's susceptibility to secondary-recovery methods**—Report of subcommittee on Secondary-recovery methods, Division of Petroleum, AMERICAN PETROLEUM INSTITUTE, Chicago Meeting, November, 1943.

The Committee sets forth that the urgency for increased production of certain types of crude oil required for the war effort, which may not be secured in adequate quantity immediately by exploration for new fields, and the pressing need for petroleum products near centers of large consumption, provide an important opportunity for expansion of secondary-recovery operations. It is further pointed out that such operations can be effected in many cases with a minimum of new materials, by the utilization of existing wells and by the use of second-hand equipment.

However, it is pointed out that intending operators should approach such projects, in a manner of speaking, with their eyes open. The fact that secondary-recovery operations may yield very satisfactory results in one certain field is no definite criterion that the same degree of success will be attained in others, even though they may be located in close proximity and produce from the same oil-bearing formation. Unfortunately in the past elaborate plants, involving very considerable investments, have been installed without proper investigation of reservoir conditions, just because secondary-recovery operations in nearby areas have been successful. By accident, some of the projects so commenced have produced a satisfactory recovery, but in other instances the increase in production has not been sufficient to return the development expense.

Again, it is not sufficient to select a sound project. Too frequently, the operator, after making a careful and exhaustive study of an area in a field, is content—after the installation of enlarged storage capacity to take care of the anticipated increase in production—to relax and give little attention to the reaction of the reservoir to the injection of gas or water. Such procedure cannot be approved, because readjustments in reservoir conditions, brought about by the injection and withdrawal of fluids, may make desirable radical changes in operating practice long before the time of secondary depletion has been reached.

This report serves as an introduction to a symposium on the conditions which determine an oil field's susceptibility to secondary-recovery. Abstracts of several of these papers are given below.

**Surface tension effects in secondary Recovery**—(A.P.I., November, 1943), by Paul D. Torrey.

Research performed at the University of Michigan on the physical chemistry of the displacement of reservoir fluids is reviewed with reference to its possible application to secondary-recovery methods. Physical conditions under which water will displace oil are discussed, and the effects of polar compounds occurring in the oil in determining the ease of displacement are emphasized. It is believed that more comprehensive studies may provide a solution to the problem of variable percentage recoveries of the residual-oil content after the primary phase, and also point the way to the recovery of enormous quantities of oil which cannot be produced economically under existing conditions.

Unfortunately, the information available to date regarding the interfacial forces operating at the contact between oil, water, and a solid have been studied principally for pure silica and pure calcite. Both of these minerals are regarded as being hydrophilic substances but, regrettably, the effect on the relative degree of wetting of the reservoir rock by oil and water where the principal mineral may be coated or bonded with clay cements of various compositions is unknown.

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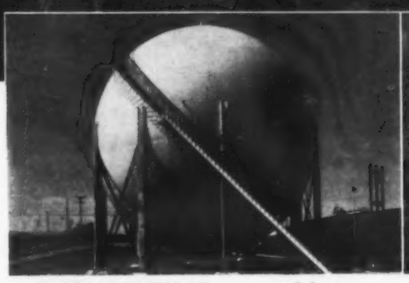

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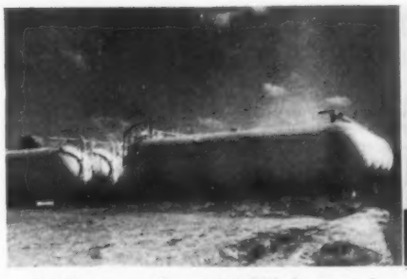

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While it is recognized that the information so far developed on surface-tension effects is not sufficiently detailed or complete to enable prediction of the degree of success that may be expected from water-flooding operations in previously untested fields or areas, assuming the favorable determination of other important factors, there is justification for believing that an encouraging approach to the solution of the problem has been provided by the studies of interfacial contact angles described herein. It is so evident that the relations already established may be some of the controlling criteria determining the success of water flooding that additional and more comprehensive research certainly is desirable.

**Theoretical calculations for use in the installation and operation of Secondary-Recovery projects**—(A.P.I., November 1943), by George H. Faucher.

Recovery of oil by secondary-means depends upon two fundamental conditions: (1) A positive difference in pressure must be established between remote portions of the sand body and the sand face of the oil-well bore; (2) some fluid must replace the oil that is removed from the pores of the production sand. Practically speaking, the operator must rely upon the encroachment of water or oil that is under hydraulic head or gravity drainage, and upon the expansion of gas either from gas zones or from solution in the oil.

Where one and the other of these driving forces are absent, as frequently occurs in the shallow or the older oil fields, they must be supplied.

The physical fact which must be kept in mind is that there is a definite limit to the amount of oil which can be removed from the sand by creation of pressure differences and encroachment of fluids. This quantity of oil is usually termed the "residual saturation". For many sands the residual saturation, never zero, is an appreciable percentage of the total saturation, and consequently the percentage recovery of oil actually may be much less than would appear to be possible.

It has been demonstrated that, in general, the residual saturation for a sand is lower when water is the displacing fluid than when gas encroaches. In other words, the recovery by water drive usually exceeds greatly that by gas drive. But water will not remove all the oil from a sand. A 10 to 30 percent residual saturation usually remains even after the most efficient of water drives has passed. Though the pores of an oil sand may be from a tenth to a quarter filled with oil, the oil will not move through the sand because the effective permeability of the sand to oil may be zero under these conditions. Consequently, the residual-oil saturation for water drive should be compared to that for gas drive in considering the application of secondary-recovery methods to a definite field. Unfortunately, the residual-oil saturation cannot at present be calculated theoretically, but it can be measured, although with some difficulty.

Equations are available for the control of injection rates and pressures of water drives, but similar equations cannot be given for secondary recovery by gas injection because of the physical differences between gas injection and water drives. Water flushes the sand and decreases the percentage oil saturation and increases temporarily the oil content of the sand ahead of the water-wave front. Consequently, the effective permeability of the sand-to-water, in the water-flushed portions of the sand, increases; and the effective permeability of the sand-to-oil, ahead of the water-wave front, also increases. On the other hand, because gas is soluble in oil, and no wetting action based on interfacial relations is possible, and because of the expansibility of gas, gas in a gas-injection process always tends to travel through these passageways in sand which contain the least oil. As Hassler puts it, oil is "dragged along" by gas in gas injection, and not "pushed". Consequently, while the percentage oil saturation decreases as gas passes through sand, the effective permeability of the sand-to-gas throughout the sand increases, while at the same time the effective permeability to oil decreases. In other words, it becomes easier and easier for gas to pass through the sand and more and more difficult for oil and, as a result, gas-oil ratios rise and may become excessively high.

However, the choice between water and gas drives is governed by economics; the operator is generally interested more in profit than in oil as such. The efficiency of gas drive is generally low, but it is fast, and the principal reason for using it is to hasten recovery of oil from the field. The choice therefore is to be settled by engineering and economic calculations.


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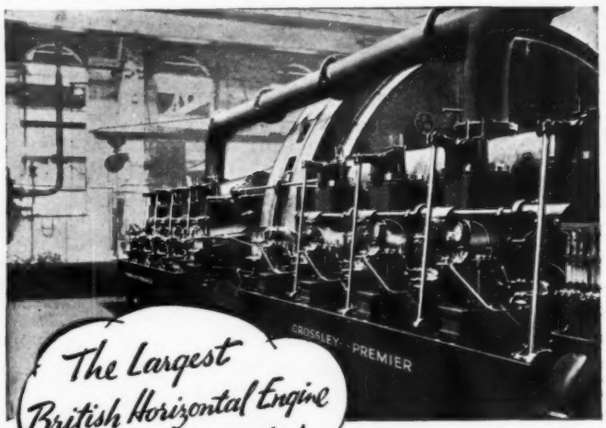


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**Geological Factors Influencing Secondary-Recovery Operations**—(A.P.I., November, 1943) by Charles R. Fetke, Parke A. Dickey, Douglas Rogers, Jr., Paul D. Torrey and C. J. Wilhelm.

Whether an oil pool or a tract has secondary recovery possibilities depends on the underground geological conditions. The first thing is to assemble all available geological information. This information should be sufficient to permit making a structure map on top of the sand and an isopack map of the sand. If preliminary investigations have shown secondary-recovery possibilities a core-testing program should then follow to check the geological data and to obtain information on porosity, oil and water saturation, and permeability of the sand.

It is not to be overlooked that past performance of the reservoir will give some clue as to recovery possibilities. If natural water encroachment has been active and uniform the residual oil content is apt to be too low, except where relatively thin zones of high permeability have permitted water to drown out much oil in less permeable strata, and which might be recovered if high permeability sands can be plugged off. Again, where the pressure of an original gas cap has been wasted the residual oil content may be large—larger than where the reservoir was produced by internal gas drive. In general, where the primary performance was good, little is likely to be left for secondary recovery.

The necessary geological information is obtained from old oil wells, supplemented by adequate coring. Many oil sands are remnants of ancient channel, delta and beach deposits or buried off-shore bars, all of which frequently have peculiarities of permeability. Most secondary operations thus far have been in fields with moderate structural relief; in any case, the structure will generally indicate the method of repressuring to be used.

While the most important information about a secondary-recovery project is the extent of oil saturation, the next most important is the degree of homogeneity of the sand, and this must be adequately shown by the cores. Homogeneity is to be considered from the standpoint of porosity, uniformity and size of the grains, kind and amount of cementing material, pore-size distribution, permeability and fluid saturation vertically and laterally. If the permeability ranges widely there may be highly permeable layers with low saturation to be packed off, unless shaly layers permit different sand layers to be treated separately. The most successful water floods have been those in sands of relatively fine texture, after depletion by primary methods such sands retain the largest percentage of the original oil, and they are generally more uniformly permeable. In any case the size and shape of the pores need investigation; uniformity of pore size is favorable to high recovery. Minerological composition of the sand is mostly of importance as regards the presence of clay minerals that swell in water, and pyrites which may generate acid that corrodes the equipment.

As regards the spacing of recovery wells, the authors consider that the pattern may well fit the geological pattern of the sand, especially in narrow "shoestring" sands. Laboratory experiments indicate that water flooding is more efficient than air or gas injection, and field results on the whole appear to bear this out.

**Preliminary field tests for determining required injection volumes, pressures and plant capacity in secondary recovery projects**—(A.P.I., November, 1943) by Jo. H. Cable.

In designing a secondary-recovery project by gas injection, all available cores, sand chips and cuttings, samples of produced gas, oil and water should be collected and analyzed. Maps should show all wells, subsurface structure, tanks, pumps, houses and pipe lines. Records of casing head, separator and gas-system pressures, and the condition of all underground and surface equipment should be available; if air is to be used, it is well to know if there has been corrosion.

The first problem is a determination of the necessary initial injection volume. Usually it will be 25 to 50 percent of the current gas production; input volumes may vary from 300 to 2,000 cu. ft. per day per vertical foot of exposed producing horizon. For a greatly depleted project nearly all of the previous maximum gas production may be required. In general, the maximum requirement may be computed by estimating the future maximum oil production and multiplying it by the anticipated gas-oil ratio, which usually increases 100 to 200 cu. ft. per bbl. of oil with controlled injection. Required injection pressures usually runs 10 to 25 per cent higher than the bottom hole pressure, or 100 per cent in tight formations. Actual requirements may be determined by a test plant or by trial injections, and may be kept at a minimum by packing off less permeable sections of the producing horizon.

In planning a water flooding project the same basic information is needed as for gas injection.


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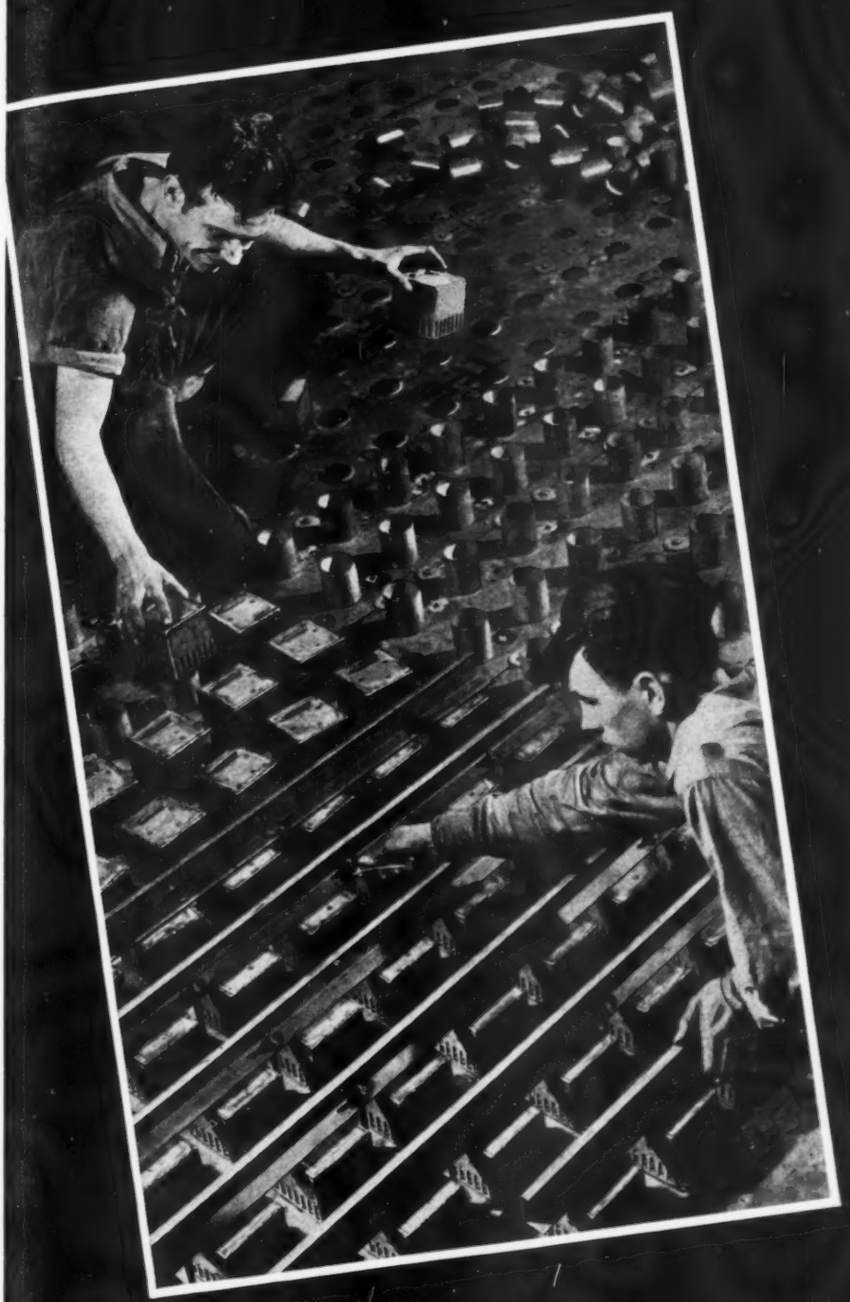

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Experience in water flooding has shown that the best results have been obtained with injection volumes of 2 to 5 bbl. of water per day per vertical foot of exposed producing horizon in the injection well. This is an average volume figure, and may be modified by such factors as the area served by the injection well, the void space to be filled, and the actual performance of the project. Water should be applied to the sand uniformly over the entire area of the project according to the reservoir conditions in the underlying acre-feet of producing horizon. The indicated volumes required to accomplish this are determined from the core or chip analysis. Experience has shown also that, over the life of the water flood, the total input water volume will probably vary between 5 and 20 bbl. per bbl. of oil produced. An average figure is 10 bbl. of water per bbl. of oil produced.

Production rates in water flooding are a function of both the pressure and the volumes injected. The pressure required is a function of the frictional resistance of the sand (therefore, a function of the rate of injection), and of the degree of penetration of the pores of the sand, and the extent of displacement of oil and connate water by flooding water. Although much of the frictional resistance is encountered in the immediate vicinity of the bore hole, nevertheless, the overall resistance is important. There is both field and laboratory evidence to indicate, if not to substantiate, that the higher the pressure developed in the producing formation, the more complete is the flooding out of all pores and the greater the recovery of oil.

However, experience has shown that the maximum water flooding pressure applied at the surface should be not more than 2 lb. per ft. of depth, less the equivalent of hydrostatic head, otherwise the overburden may be lifted and the water migrate along the bedding planes.

**Influence of Fluid Saturation on Secondary Recovery of Oil**—(A.P.I., November, 1943) by Parke A. Dickey.

The most important single fact that determines the success of a secondary-recovery operation is the amount of oil recoverable. This amount is determined by the amount of oil in the sand. Possibly the next most important fact is the injected gas-oil or injected water-oil ratio necessary to recover this amount of oil. These ratios are determined by the gas and water saturations of the sand. It is clear that if these quantities were determinable by cores in advance of the heavy development expense incident to either gas or water drives, much of the hazard would be removed from secondary-recovery operations.

Another conclusion to be derived from a study of fluid saturations is that the higher the oil saturation, the larger the percentage of oil in place that is recoverable. This fact needs a great deal more emphasis than it has received. The lifting cost of oil is usually a large fraction of the cost of production. The lifting cost depends, more than on anything else, on the rate of oil production of the well. Wells with low rates produce oil at disproportionately high lifting costs. As a rule, gas or water drives are not initiated until the economic limit has been reached, and the lifting cost has attained the selling price of oil. It would be much better to start secondary-recovery operations while the wells still were producing substantial amounts of oil. The ultimate recoverable oil would then be obtained much more quickly and, therefore, much more cheaply. In many cases much more oil could be obtained. Perhaps the most obvious example is a field whose upstructure wells produce at a high gas-oil ratio. Many such fields are now allowed to produce gas from the high gas-oil-ratio wells, partly for the oil and partly for the gas. The oil in the more richly saturated parts of the pool is migrating upstructure, and ultimately may spread itself so thin by wetting dry sand that it cannot be recovered by any secondary-recovery method. Gas should be either recycled and driven downstructure, resulting in the recovery of the same gas with large amounts of oil, or a water drive should be started downstructure before the gas pressure has been removed.

In fact, it might be possible to start both gas and water drives simultaneously after the discovery and definition of a new pool. Gas should be reinjected at the top of the structure to maintain the original pressure, and water should be injected downstructure equal in volume to the oil removed and the gas used for fuel. If this were done, it might be possible to reduce the oil saturation in the sand to the neighborhood of 20 per cent, and recover all the oil by flowing without ever having to install a pump.

**Prediction of Secondary Recovery from Core Analysis**—(A.P.I., November, 1943) by R. C. Earlougher.

Core analyses are most essential in the evaluation of an oil property for secondary-recovery possibilities. In many areas and for many sands the success or failure of secondary operations may be determined to a large extent by cores of the oil sand and subsequent analyses. With a sufficient number of cores spread over the property so as to obtain a representative picture of sand continuity and areal extent, it is possible to determine ultimate oil recovery, desired water injection rate, plant pressure, well spacing, time required to obtain a substantial increase in production, and length of time to economical depletion of the project. These factors all refer to secondary recovery by water flooding. In some of the areas where water flooding has been in progress for many years, so that sufficient correlative field data are available, it is even possible to anticipate with a high degree of accuracy the actual production curve that will result.


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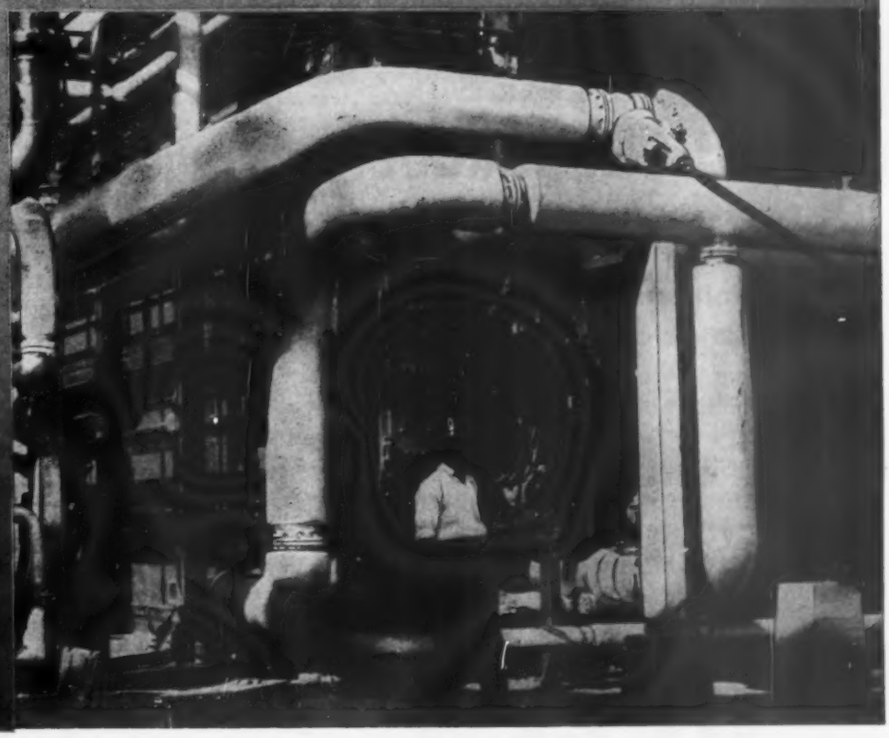

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In other areas, and under varying conditions, the use of core analyses is very limited at the present time; and the chief advantages are the determination of whether the permeability is sufficiently high to be adaptable to secondary recovery, an accurate determination of net feet of floodable sand, the presence of a gas cap which should be packed or cased off, total reservoir pore volume and, possibly, the connate-water content if oil is used as the drilling fluid during coring. As additional field experience is available in such areas, it is very probable that in the future cores from them may be as valuable as those of the first type. It does seem probable, however, that accurate past production records will be necessary to use the cores to greatest advantage.

One of the most important factors is that of determining the desired shot to be used for sands of different permeability in order to even the flood front through the vertical sand section. Until better means are devised, this appears to be the best way to correct for wide variations in permeability and reduce to a minimum water bypassing through the more permeable sections.

Calculations based on theoretical formulas should be used with great care and caution unless substantial field data are available for correlative purposes.

It should be stated again that cores from shallow sands or sands depleted of practically all solution gas can be used successfully to predict the success or failure of a water-flooding development and also a gas-injection program. Cores from deeper sands, on the other hand, which still have appreciable gas in solution in the oil, cannot at this time be used to any such degree of success.

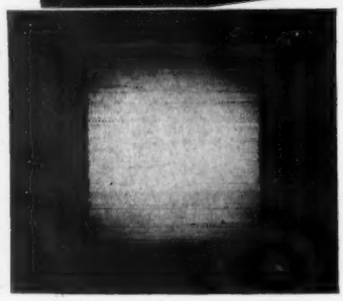
**Influence of Viscosity of Crude Oil on Secondary Recovery**—(A.P.I., November, 1943) by W. A. Heath.

Viscosity of the oil is important in secondary-recovery operations, as it is one of the factors that affect the spacing program and operating life and has a bearing on the amount of economically recoverable oil. From the practical standpoint, we are interested in the degree to which viscosity affects each of these factors. Theoreticaly a 10-centipoise oil requires twice as long a period for secondary depletion than a 5-centipoise oil, other factors being equal. Whether the mixture of connate water, gas, and oil under reservoir conditions affects this simple viscosity proportion has not been established; therefore, we can but assume the validity of the theoretical relationship.

In order to deplete a 10-centipoise oil in the same period of time as required to deplete a 5-centipoise oil, it would be necessary to adopt a closer spacing pattern with twice the number of injection wells—presuming, of course, that the maximum injection pressure and volumes are used in each case. In many cases land subdivisions, sand continuity, spacing of existing wells, pumping-equipment capacity, and the personal equation regarding the proper injection volumes control the spacing pattern and flood life to a much greater degree than viscosity.

In summary, it seems apparent that, to a given economic limit of water-oil or gas-oil ratio, the more viscous oils will yield less recovery than the less viscous oils, other conditions being equal. The magnitude of such difference has not been evaluated in field experience. In general, within the small range of viscosities in which secondary-recovery operations have been conducted, other factors have more weight in determining the amount of recoverable oil than viscosity alone. On the other hand, the influence of viscosity of the oil in governing the rate of fluid travel and, therefore, the flood life and development investment will by far outweigh the influence of viscosity on residual saturation in determining the economic success of water flooding of the shallow, less permeable reservoirs.


OCECO FLAME ARRESTORS



*At the left,*—Oceco Flame Arrestor Element photographed against the light, showing the absence of obstructions,—resulting in free venting, and easy inspection...Above,—section of Oceco Flame Arrestor Element actual size.

*Above,* Oceco Flame Arrestor—complete unit showing the rigid semi-steel gas-tight housing...cover opened and arrestor element partially removed.

**with their STRAIGHT THROUGH passages**

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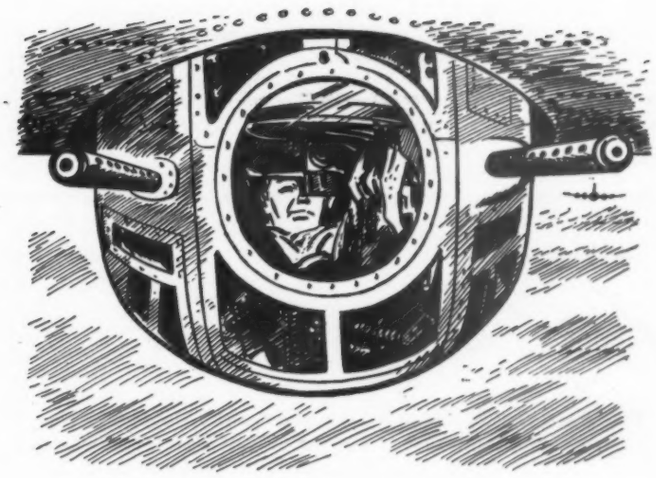

**The first satisfactory oils for aircraft hydraulic controls were made possible by the discovery years ago of petroleum additives for raising viscosity index and lowering pour point of petroleum oils.**

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***STANDARD OIL COMPANY (NEW JERSEY)***

***AND AFFILIATED COMPANIES***

## GENERAL

**Time as a Factor in Economics of Oil Field Exploitation**—Lester C. Uren, in PETROLEUM ENGINEER, vol. 15 (1944) No. 4, pp. 116, 118, 120, 122.

In this article it is shown that time is a factor of primary importance in planning the exploitation of an oil producing property. Wells must be drilled at a suitable time in relation to surrounding development, otherwise the owner of the tract on which they are situated will suffer an irreparable loss. In gas drive fields, later drilled wells characteristically display smaller initial and ultimate recoveries than do the early wells in the same locality. In water drive fields, the later drilled wells suffer a loss in ultimate recovery, but do not necessarily in the initial rate of production. These conclusions apply particularly to uninfluenced, competitive fields and may be modified to some extent by proration practices and by application of the pressure-maintenance method of exploitation. Delay in development may also occasion additional loss as a result of deferred realization of profit on oil and gas production. The market demand and selling price of oil may dictate the exploitation program. compelling a slower rate of development than other considerations might require. Lack of available capital for rapid early development of producing properties is responsible for delay with many operators.

## OPERATION

**Wellhead Pressure Reduced by Subsurface Regulation**—John O. Farmer, in PETROLEUM ENGINEER—Vol. 15 (1944), No. 4, pp. 160, 162.

A condensate-gas well on a salt dome structure in Louisiana which is produced from perforations at a depth of 9350 feet developed a shut-in pressure of approximately 5650 psi. Under the prevailing circumstances it was necessary to reduce this pressure by 4200 psi for safe working limits within which hydrates would not form in the plow lines. Heretofore such situations have been handled by installing subsurface regulators—usually single stage appliances operating at pressures between 1000 and 3000 lbs. Some progress has been made with dual installations. Since the maximum pressure reduction that can be effected by single stage regulation is 1500 lbs. the problem was presented of employing a triple arrangement in order to keep the flowing pressure within safe non-freezing limits.

Three 2½ in. subsurface regulators with ⅜ in. Kennametal valves and valve seats were installed at depths of 6250, 5000, and 3750 ft. The regulators were set in the conventional manner by means of an ordinary steel measuring line. The regulator set at a depth of 6250 ft. was adjusted to accommodate a pressure differential of 1500 lb. per sq. in., the regulator at 5000 ft. was set for a differential of 1400 lb. per sq. in., and the regulator at 3750 ft. was set for a differential of 1300 lb. per sq. in. After opening the wellhead connections for the desired rate of flow, the flowing pressure on the tubing stabilized at 900 lb.

The results obtained from this first triple subsurface regulator installation are considered quite satisfying. The regulators were installed in the conventional manner, demonstrating that subsurface regulators can be installed safely with a wire line in wells having surface pressures in excess of 5000 lb. per sq. in.

In three months' continuous operation, no servicing has been needed as no trouble has been encountered. Undoubtedly, the use of durable monel valves and seats with Kennametal inserts is responsible to a great extent for the absence of trouble from corrosive or abrasive flow action.

The operation in general proves further that, provided there is sufficient bottom-hole temperature, multiple staging of subsurface regulators is the most practical and safest means of handling high pressure wells, and may become the adopted method of producing other wells in this category in the future.

Our thinking along the lines of a prefabricated house is for a permanent, livable home in the low-cost field that any purchaser will be proud to call "home". We're not trying to build a "dream creation", but a sound livable home plan, a house that can be merchandised with profit by retail lumber dealers and other established retail dealers. It will be available for export, as well as for the United States.

Naturally, at this time our planning and research department is still busy with preliminary house plans, such as the one illustrated above. Many such plans will be drawn, considered from all angles, and discarded, before our final post-war prefabricated home emerges, ready for field testing before the production line is set up.

At the present, we are engaged in vital war work for our Government, and our entire facilities will be kept on this work as long as needed. In the meantime, if you haven't already requested details of our packaged plan, when ready, write us now, so that you will receive this information as soon as it is available.

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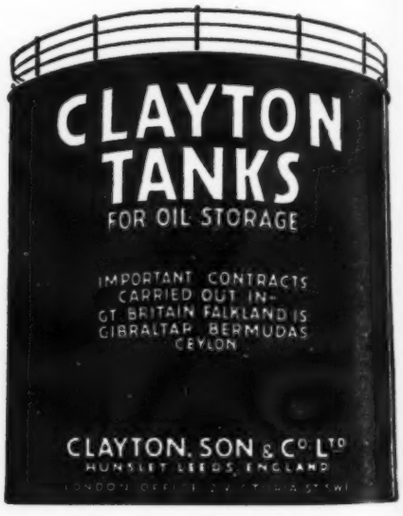
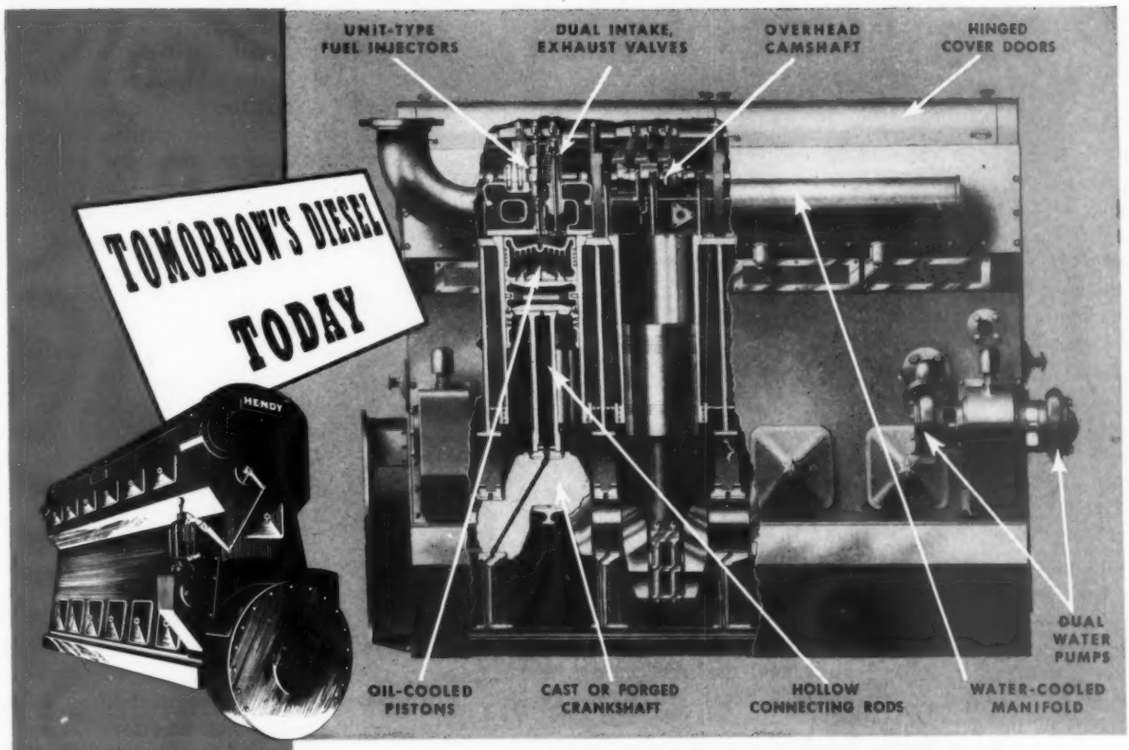
Prefabricators Since 1917
POLK AVENUE HOUSTON, TEXAS



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at 450 rpm.
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## PIPE LINE AND WORLD POLITICS

(*Continued from page 33*)

Ickes has declined to discuss this phase of the subject on the ground that it concerns other government departments and is outside his domain which he defines as that of finding oil to supply national needs.

If the American companies engaged in oil operations in the Middle East require financial assistance in developing their properties or transporting their oil—of which there has been no indication—that result can be obtained just as readily and with far more safety through a loan such as the government has been willing to make for the promotion of wholly foreign enterprises. The oil companies, it should be noted, did not invite government partnership and it is easy to understand that they could hardly reject the offer that has been made to them in view of possible consequences.

In commenting upon this subject in these pages a month ago the belief was expressed that this particular move of the Washington administration was part of a scheme of world strategy in which the oil needs of the United States were only a minor consideration. Despite disclaimers this conviction still stands. On no other assumption is it possible to explain the insistence upon government ownership, the specification that the commercial practices of the companies must conform to the foreign policy of the United States and the requirement that the State Department shall possess a veto power over sales to other governments or their nationals.

To say this is not necessarily to condemn such an ambitious undertaking. Beyond question the control of the world oil supply or of a large part of that supply will become in the future even more than it has been in the past an important factor in determining industrial and military strength, in deciding the ability of well-disposed nations to preserve peace or the capacity of the aggressively inclined to embark on schemes of conquest. The force of events—perhaps an irresistible force—appears to be moving the leaders of the United Nations toward a realistic appraisal of post-war conditions and away from the idealistic principles so hopefully announced in the early period of the war.

It may be that power politics, the exercise of superior force by a small group of powerful nations, offers the only hope of preserving order and avoiding chaos as a result of the complete disorganization of economic life in practically all of Europe and in many other parts of the world. Signs are not lacking of a trend toward the adoption of imperialistic methods if not of imperialistic aims in the regulation of international affairs at the conclusion of the war. If this trend continues it may very probably lead to the control of critical materials to enforce the political aims of the dominant powers.

So far as oil is concerned it certainly would figure as one of the key commodities in any such plan of politico-economic control. It is not to be assumed that the United States would be able or would attempt by itself to exercise a dominating influence in the world oil situation. Such control presupposes a definite understanding with Britain and the acquiesence if not the active participation of the Soviet Union. These three, together with the influence that they could exercise, might readily and for a considerable time dictate the course which the flow of oil might take and the extent of the supply allowed to suspect nations.

If something of this sort is in contemplation it removes the proposed entry of the government into the troubled arena of Middle East affairs from the status of an effort to provide petroleum products for the armed forces of the country or to meet a deficit in domestic supplies, or even to aid American companies in finding adequate outlets for their production. It transfers the question from an oil problem to one of world politics. Even so it does not follow that government ownership of a Trans-Arabian pipe line is essential to the objective in view. The same purpose may be accomplished in other ways, some of which have been pointed out, with far more certainty and far less risk of entanglements threatening to the future peace of the country and without infringement of the principles that have guided it in the past.

If the project put forward by the head of Petroleum Reserves Corporation with the support of the top officials of the civil and military administrations is merely a plan to provide against a possible oil shortage, it should be supported by better reasons than those thus far adduced. If it is part of a more far-reaching scheme that fact should be clearly explained to the American people.

## High Octane Unit Occupies Original Standard Site

Located on the site in Cleveland where the Standard Oil Company was first established in 1870 a new high-octane unit of Standard Oil Company of Ohio's refinery is turning out aviation fuel for American fighter and bomber planes. Construction of the plant began in September 1942 It represents an investment of about $8,500,000 and employs the Houdry catalytic cracking process under license. The plant is said to have a daily capacity sufficient to fuel one hundred heavy four-motor bombers on a round trip from the British Isles to Berlin every twenty-four hours.

E. B. Badger & Sons Company had charge of the engineering and erection of the plant.

Bradley, Coverdale : one of the W. P. Butterfield series of Yorkshire Dales scenes.

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The modern version of 'swords into ploughshares' must presently apply, though (having learnt our lesson) more gradually than before. In any case, Butterfield Tankers have pulled their weight manfully in the struggle. The working of UNRRA will mean a priority call on Road Tanks for the bulk transport of supplies of petroleum and fuel oil essential to transport itself, and thus to all plans and activities for relief and rehabilitation.

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# Hydroforming Plant for Toluene Production

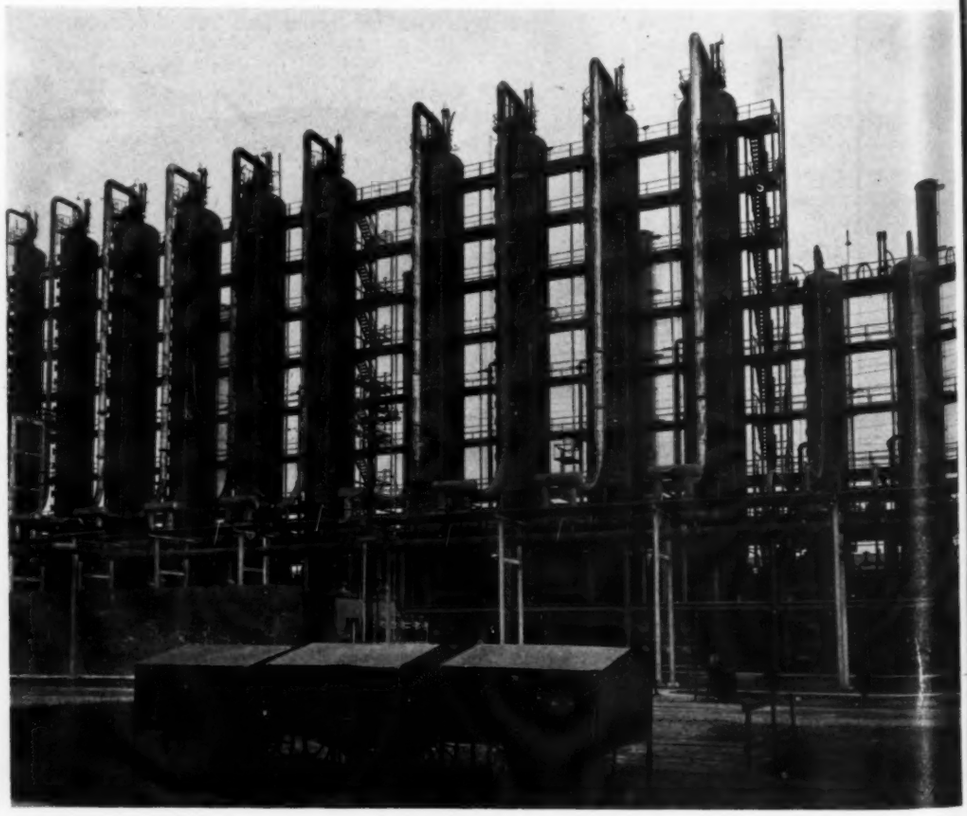
DISCOVERED more or less accidentally in the course of investigations directed to the development of hydrogenation, a method of producing toluene from petroleum got its start in the laboratories of the Baton Rouge refinery of Standard Oil Company of Louisiana a dozen years before the present war came to the United States. Further studies and experiments conducted on the advice of the U. S. Army Ordnance Department led to the gradual improvement of the process and brought it to the pilot plant stage where it was found that results depended largely on the type of feed stock selected.

Dozens of stocks were tested before one was discovered that yielded appreciable quantities of toluene. An adaptation of hydrogenation called hydroforming produced a product of 99.7 percent purity. This was still a laboratory development which had not been submitted to the test of commercial production. At the Army's request, however, Standard estimated the amount of toluene the new process could produce and offered to build a special plant. This was in 1939 and by June of the following year the war clouds had gathered so threateningly that the Army placed an order for two tank cars of synthetic toluene, some 20,000 gallons. There was no time to build a special hydroforming plant and the only way of filling the order was to move materials from point to point for successive steps in their treatment. From the Baytown refinery of the Humble Company in Texas 25,000 bbl. of feed stock were shipped to Bayway, New Jersey, where the hydroforming was done in hydrogenation equipment hastily altered for the purpose.

Emerging from this stage the hydroformed cut was returned to Baytown for further purification. From there it was transferred to Baton Rouge for the distillation of 99.7 percent toluene. The final lap in its travels carried it to an explosive works of the Dupont Company for nitration into TNT. By such emergency means was the first commercially made synthetic nitration grade toluene from petroleum made available and assurances provided that a vastly greater supply could be produced.

While this was going on a $12,000,000 synthetic toluene plant was being erected for Army Ordnance by the Humble Company at Baytown. Its construction was finished some six weeks before the Japanese attack on Pearl Harbor. During the first year of the war it supplied nearly two-thirds of the country's requirements of toluene for military purposes. The process was made available to the entire petroleum industry and other plants have since been put into operation in other places.

*Army Ordnance Plant for Toluene Products at Baytown, Texas.*



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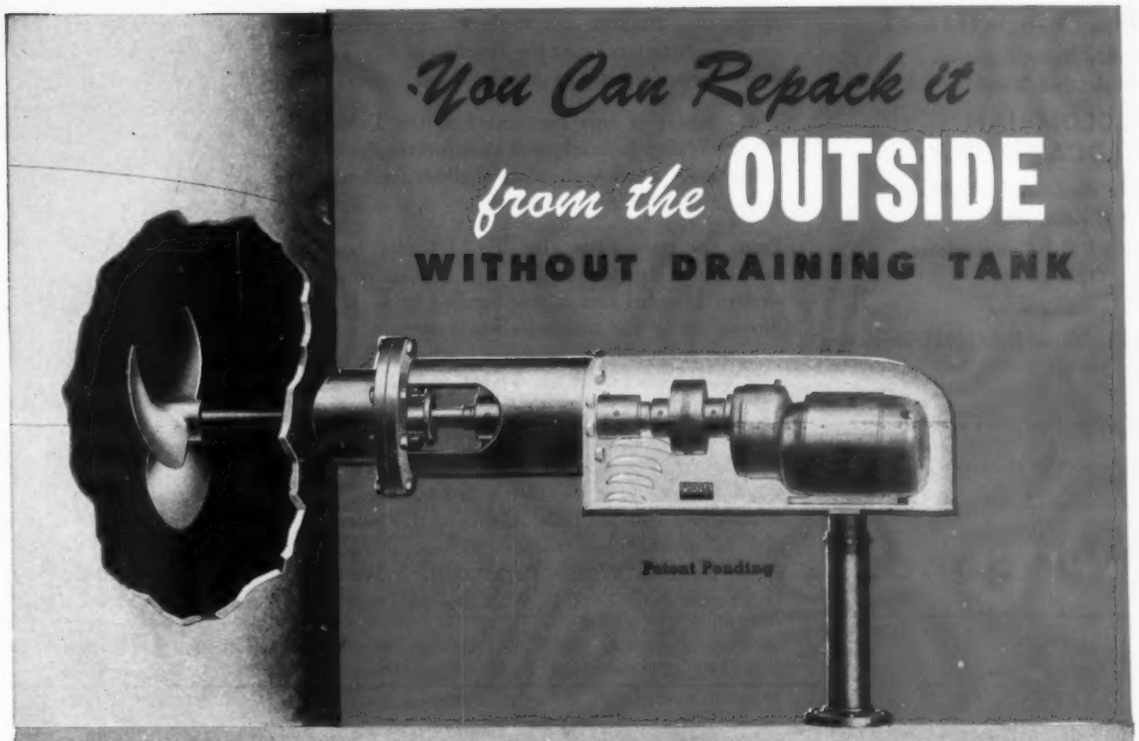
**WITHOUT DRAINING TANK**

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Established 1866

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## MARLEY OFFICE CHANGES

THE Marley Company, cooling tower manufacturers with main offices in Kansas City, Kansas, announce personnel shifts resulting from raising their Houston office to the status of a divisional headquarters under the direction of Ray T. Jenkins who formerly headed the Tulsa division.

The company is now represented in the Tulsa area by Walter S. Smith, well-known throughout the territory as an applications engineer for heat transfer equipment.

From the main office, Joe T. McKinley has joined the Houston staff. The Kansas and western Missouri area is now handled by R. H. Ahrens out of the company's headquaters.

## 1943 EDITORIAL INDEX NOW AVAILABLE

A COMPLETE index of all articles and editorial material appearing in the 1943 issues of WORLD PETROLEUM, together with a cross index of authors is now available. Copies of this index will be mailed upon request without charge. Write direct to WORLD PETROLEUM, 2 West 45th Street, New York 19, N. Y. for your copy.

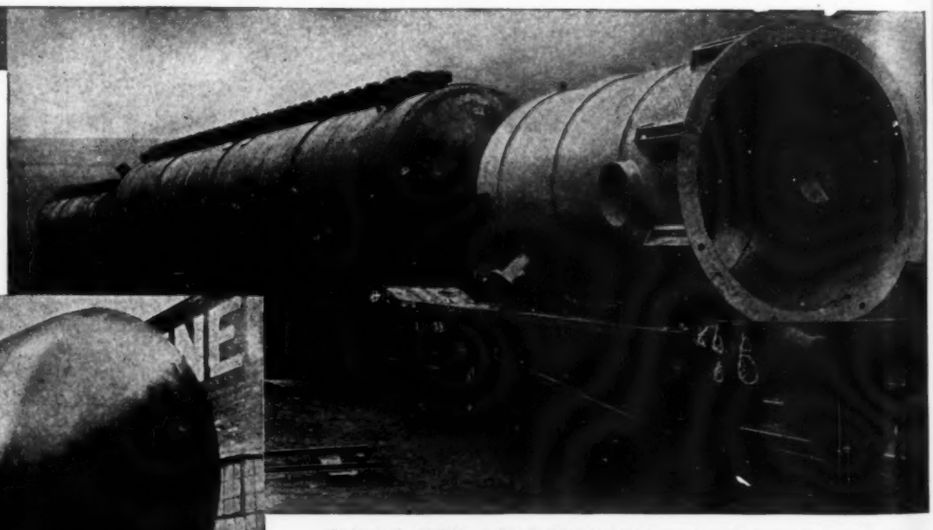
## CORRECTION

IN AN article entitled "Apparent Rise in Oil Industry Earnings Illusory," written by J. E. Brantly, and published in the November number of World Petroleum, an error occurred in printing certain statistics relating to additions to known oil reserves through discoveries. In quoting from a previous compilation of such statistics by Dr. F. H. Lahee, the figure representing discoveries during 1942 was assigned to 1941 and the proper figure for the latter year was omitted. The figures, which appeared on page 48 of the issue referred to, should have read as follows:

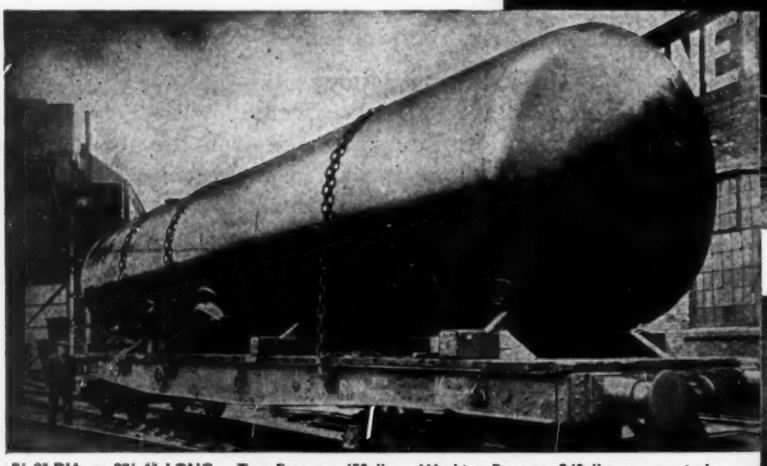
| *Year* | *Bbl.* |
|---|---|
| 1938 | 805,293,000 |
| 1939 | 337,989,000 |
| 1940 | 280,882,000 |
| 1941 | 423,551,000 |
| 1942 | 254,801,000 |

The error arising from the assignment of the correct 1942 figure to the previous year did not affect the validity of the conclusions drawn in the article but the correction is made in the interests of statistical accuracy.

WELDED
PRESSURE
VESSELS



5' 0" & 6' 6" DIA. × 90' 6" TOTAL HEIGHT. Lloyds Survey & A.S.M.E. Code.



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PARKFIELD WORKS STOCKTON-ON-TEES

# A VETERAN PUMP RETURNS

*Above Is an Unretouched Reproduction of This Remarkable Pump as It Appeared When It was Returned for A Complete Check-up and Modernization.*

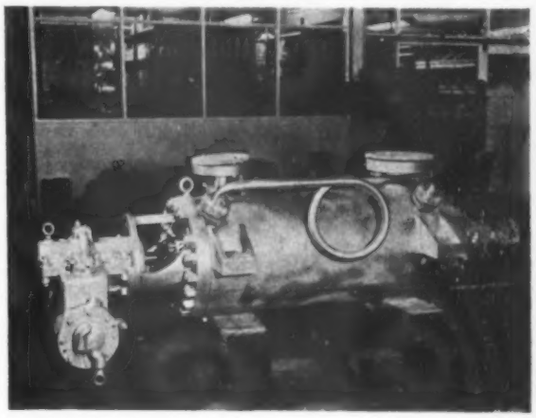
HOME after ten years, a Pacific veteran 4", 10-Stage, Type I.T.B. centrifugal pump was recently put through a check-up and sent back into action after minor repairs. Out in the field again, this veteran continues in service under pressures of 1750 pounds and temperatures up to 850 degrees Farenheit. They've got to be tough to take this kind of treatment. Ten years is a long time in the life of a high temperature, high pressure pump. This one is a double case pump with forged steel outer case and chrome steel inner case and fittings.

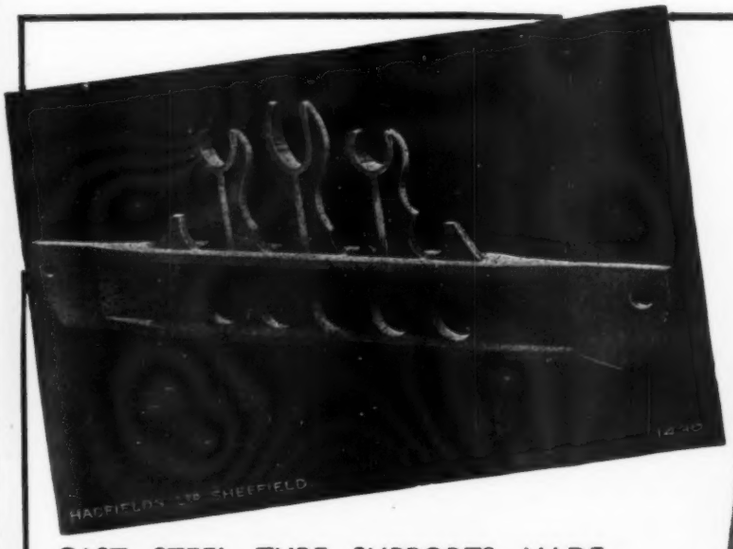
This veteran I.T.B. Pump served its tours of duty in a large West Coast refinery. Driven by a 900 H.P. steam turbine, it poured out the fluid at 680 G.P.M., operating at 3450 R.P.M. It went into action June 1, 1933 and came out for minor repairs August 28, 1940, being shortly thereafter returned to duty.

The latest repair job was completed in November, 1943, when the pump was modernized with Pacific's newest patented stationary floating seal. As placed on this pump, this seal has accomplished the reduction to a minimum the leakage which accompanies any hydraulic breakdown pressure device of the type required for high pressure, high temperature, or the combination of both. It also gives the pump the additional advantage in its design of an automatic, self-adjusting, and non-seizing device, which eliminates costly shutdowns occuring where pumps are equipped with balancing drums or other breakdown pressure devices.

The only other parts required for replacement when this I.T.B. veteran came in for repair were new wearing rings, intermediate cover bushings, shaft sleeves and small miscellaneous parts which were required due to general wear and tear. After all parts were carefully checked, cleaned and refitted, the pump left Pacific's Plant in Huntington Park with the additional advantage of having "Pacific's" stationary floating seal installed for greater efficiency in service.

*Below Is the Same Pump After Modernization. The Picture, Also Retouched, Was Taken Just Before the Pump Was Shipped Back to the Same Refinery.*

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HEAT-RESISTING STEELS
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For parts of plant requiring rigidity and low scaling loss at high temperatures they are unequalled.

TRADE ERA MARK C.R.
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FOR THERMOWELLS, REACTION VESSELS, PUMP PARTS, BUBBLE CAPS.
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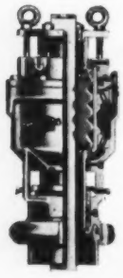

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Guiberson Drilling Head. *For completing wells by controlled pressure or reverse circulation.*

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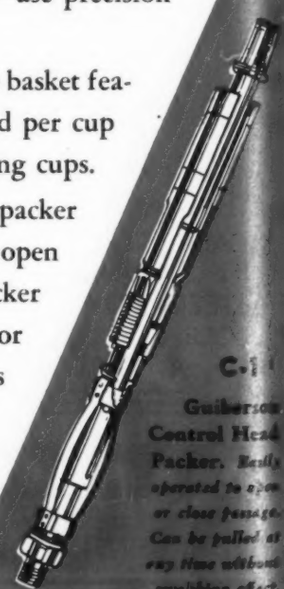

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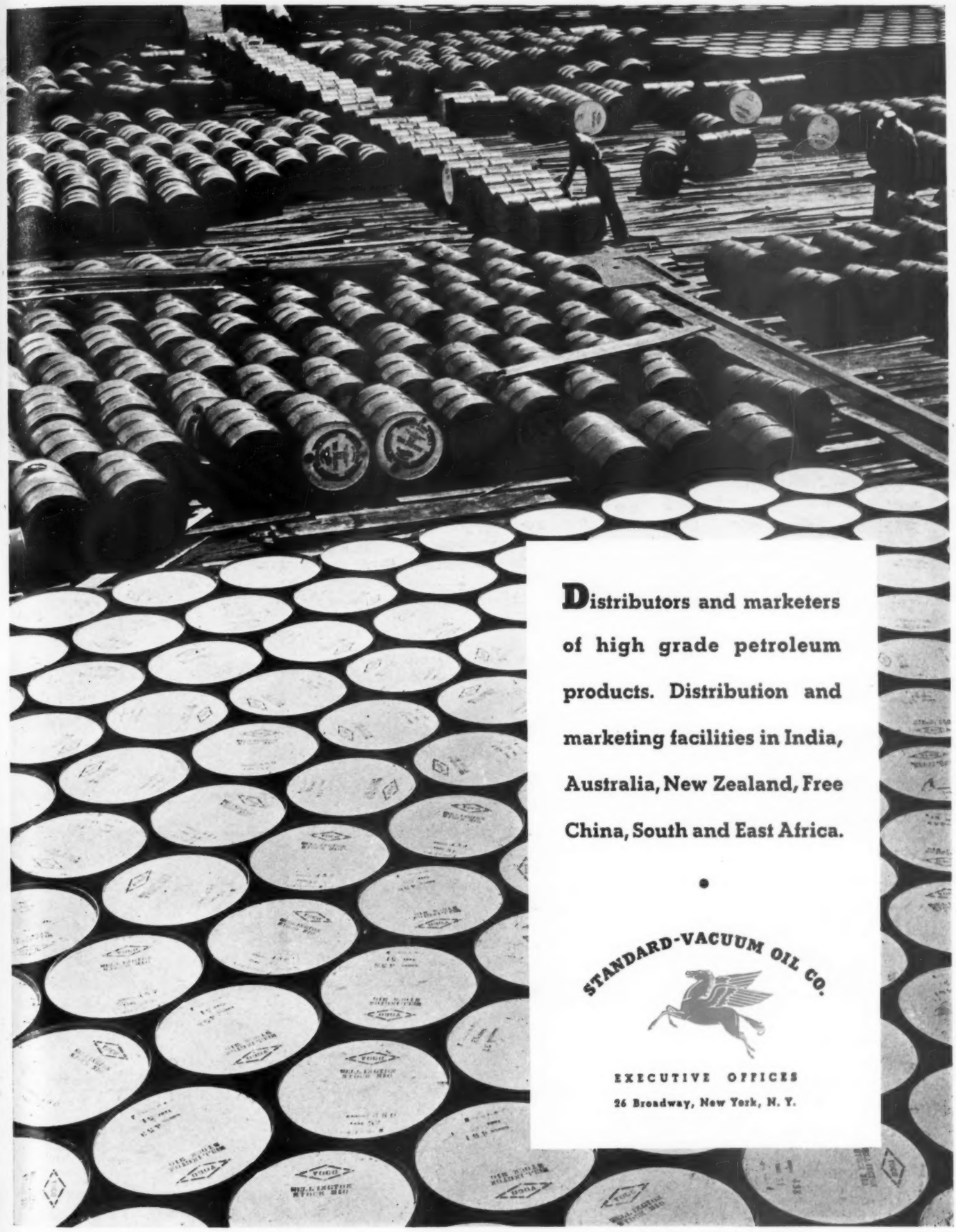

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## FREDERICK GARDNER CLAPP

WORD of the sudden death of Frederick Gardner Clapp in Chickasha, Oklahoma, on February 18, 1944, came as a great shock to his many friends. He had only recently returned from Turkey, where he was petroleum consultant to the Turkish Government, and was planning to attend the annual meeting of the American Institute of Mining & Metallurgical Engineers in New York on February 21-24 after making a short trip to Oklahoma. He was stricken with spinal meningitis and died after a few days illness.

Fred Clapp was born in Boston, Massachusetts, July 20, 1879, and graduated from Massachusetts Institute of Technology in 1901 with an S.B. in Geology. He served for two years as instructor at M.I.T. and the following six years with the United States Geological Survey. In 1908 he opened his own office as a consulting geologist and petroleum engineer, specializing in reports upon oil and gas properties, and he continued in this work and attained an international reputation as an oil and gas expert. Since 1928 he had spent much of his time in Iran as petroleum adviser to the Iranian Government.

During his thirty-five years as a petroleum consultant he carried on work in twenty-two states of the United States and in eighteen foreign countries. Besides this work he carried out investigations upon artesian water in nineteen states and some foreign countries.

His foreign work included Mexico, West Indies, Canada, Rumania, China, New Zealand, France, Palestine, Iran, Afghanistan and Turkey.

He was particularly successful in conducting extensive geological surveys of little known countries, and in the years 1936-1938 he had eight geological field parties working in Iran and Afghanistan under his supervision. His ability as a geologist and party leader is well attested by the comprehensive reports obtained in a difficult region and by personal expressions from the men who have worked with him. He had unusual ability to grasp the essential geological features of a new region and could set forth his analysis of the possibilities in a clear manner which the non-technical person could follow. His great success as a consultant for various foreign governments undoubtedly was due to this.

Fred Clapp was a fellow and member of many scientific societies and had published over one hundred twenty articles upon petroleum, natural gas and water supply, as well as geologic and geographic subjects.

He leaves a wife and young daughter, residing at Bronxville, N. Y., and an older daughter, Clara Frances Clapp, an ensign in the WAVES at Pensacola, Florida, and a son, Corporal Edward Gardner Clapp, who is with the Persian Gulf Service Command in Iran.—W. P. H.

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